THE

RUDIMENTS OF SANITATION

FOR

INDIAN SCHOOLS:

WITH A SECTION ON

DISEASES AND INJURIES & ACCIDENTS.

BY

PATRICK HEHIR, M.D., F.R.C.S.E.,

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Surgeon, Bengal Army, &c., &c.

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IN PREPARATION:

A
HAND-BOOK
OF
DOMESTIC
MEDICINE AND SURGERY
FOR INDIA:
WITH
SECTIONS & APPENDICES
ON THE
DISEASES OF CHILDREN AND HYGIENE.

BY
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Messrs. Thacker Spink & Co., Calcutta.

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OUTLINES
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MEDICAL JURISPRUDENCE
FOR
INDIAN CRIMINAL COURTS,

BY
J. D. B. GRIBBLE, M.C.S. (*Retired*)
AND
PATRICK HEHIR, M.D., F.R.C.S.E.,
Late Lecturer on Medical Jurisprudence, Hyderabad Medical School.

By order of the College, this Book is not to be taken out of the Library (except after 6 P.M. *until* 10 A.M.) *for one month from this date.*

PHYSICIANS' HALL, 13th July 1894

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PREFACE TO SECOND EDITION.

JUDGING by the success that has attended the First Edition of this little work, I feel that I have supplied a public want,—at least, in His Highness the Nizam's Dominions. The manner in which the book has been received has had the effect of stimulating me to persevere with the Science of "Sanitation," in the hope that it will become a *compulsory* subject in all Indian schools. With this view I have revised and generalised the text of the "RUDIMENTS OF SANITATION," instead of, as in the First Edition, limiting it to the requirements of these Dominions; and in so placing it before the Indian Public in an improved—though not, perhaps, in a perfect—form, I venture to hope that the necessity for a due observance of the Laws of Health will be appreciated, and that the introduction of a thorough system of Sanitary reform throughout India will, at all events, be initiated, if not accomplished.

I do not wish it to be supposed that I put this little book forward as, in any way, a complete Epitome of Hygiene; for, as already stated, the conditions under which it has been prepared preclude its being so; but I do hope that it contains in a clear and concise form the rudiments or elements of Sanitation, and that the text has been rendered sufficiently intelligible to enable boys and girls to understand the subject as far as is requisite. The simplicity of style of the text has been carefully and rigidly preserved, and, where necessary, it has been elucidated. In short, I have taken advantage, to the fullest possible extent, of the valuable suggestions and hints which have been thrown out by the Indian Press in the generous and kindly reviews which the book has received, and it is now presented to the Public after having profited thoroughly by the criticisms it has received.

I shall consider my object in publishing the book achieved when I know that Sanitation has become a compulsory subject in *all* examinations in Indian schools.

HYDERABAD, DECCAN, P. H.
February, 1891.

PREFACE TO THE FIRST EDITION.

STIMULATED by the desire to improve the sanitary condition of the people of His Highness the Nizam's Dominions, I have ventured to write the following pages, with all their imperfections, in the hope that they may, in some measure, lead to sanitary reform.

To render the subject popular and practical, all unnecessary technicalities have, as far as possible, been avoided A simplicity of style has been attempted with the object of enabling boys and girls—for whom this little book is specially intended—to understand the facts placed before them. The traditional customs of centuries are probably too firmly implanted in the less educated classes of adults to be eradicated by the perusal of any book on Hygiene. Yet one cannot refrain from calling the attention of the people of this vast territory to the glaring sanitary evils that beset them, both in their homes and their surroundings—evils which tend to cut short the thread of life, to keep them more or less constantly ailing from preventable disease, and to interfere with the proper growth and maturation of their children—evils which, it is not difficult to see, must, if left unremedied, culminate in a degeneracy of the race of which they are proud.

The subject of Physiology has been briefly discussed in certain sections, in order to elucidate the text.

This cannot be considered in any way a complete epitome of hygiene. The conditions under which it has been prepared preclude its being so.

It need scarcely be pointed out that to write, even a pamphlet on an essentially technical subject, in such language that the minds of children may assimilate the facts advanced, is a much more difficult task than the writing of a more pretentious work.

Sanitary measures have been applied with excellent effect in many towns and municipalities in India. The principles of action which have brought about these salutary changes are herein laid down. They are not unworthy of imitation in these Dominions.

If, in the least degree, my readers be induced to follow the advice given them, and to advance the cause of Sanitation in this Territory, I shall consider that my congenial task has not been undertaken in vain.

In writing these pages I have been to a considerable extent indebted to the works of many authorities on Hygiene: especially to those of Professors Parkes, de Chaumont, Dr. Wilson, Mr. Sterndale, Surgeons-General J. M. Cunningham, and Furnell, and others.

I avail myself of this opportunity of thanking my friend, Mr. E. A. Seaton, B.A. (Oxon.), for the generous manner in which he responded to my request to correct the many literary inaccuracies of the manuscript.

Hyderabad, Deccan. P. H.
1*st October* 1889.

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THE
RUDIMENTS OF SANITATION.

SECTION I.—GENERAL HYGIENE.

CHAPTER I.

INTRODUCTION.

General Causes of Sickness—Benefits of Hygiene—What is Health—Value of Health—Consequences of Sickness—Prevention of Disease—Cure of Disease—Mankind more liable to Disease than Lower Animals—Causes interfering with Sanitary Reform in India—Influence of Domestic Sanitation and Personal Hygiene—Sanitary Laws and Rules.

THE chief objects aimed at in writing this little book are,—

First.—To point out the *causes* of sickness in Indian cities, towns, municipalities, and villages.

Secondly.—To shew how these causes may be removed, avoided, or mitigated.

Thirdly.—To teach us how to keep healthy under all ordinary circumstances.

Fourthly.—To inform us what to do in certain cases of injury and disease until the doctor arrives, and in cases where no medical or surgical aid is available.

General Causes of Sickness.—In a large number of instances sickness is brought on by ourselves. We notice that some people are rarely ill; this is usually because they are careful of themselves and attentive to the sanitary state of their surroundings. Such people pay due regard to the nature of the *food* they eat, the *water* they drink, the *air* they breathe, the *clothes* they wear, and to the *cleanliness* of their persons, their houses and surroundings. On the other hand, thousands of people in India are constantly ill. This is, to a certain extent, due to climatic influences, but the greatest share of sickness is owing to want of attention to the items just mentioned. Many ignorant people think that disease is caused by evil spirits which enter the body and disturb its action. By such people incantations,* spells, and charms are resorted to, in order to drive out the offending visitor. Others consider it to be unavoidable, and in some measure necessary. Some reckon morbid† states of the body to be a special visitation of an over-ruling power; whilst other people think disease removable by fasting and prayer. Thousands in India assume that sickness is a matter of fate—that it is their *kismat*‡ to be ill. These are mistaken notions, born of ignorance and superstition. Sickness is no more a matter of chance than is any other evil which we are able to obviate. We have it in our power, to a very large extent, to prevent sickness. Modern science teaches us that disease is but a condition or state, not an entity or thing. When our food is properly taken into the system, and the waste matters promptly thrown off, all the organs of the body work harmoniously and we continue in health; but if any derangement of these functions takes place, we become ill. "Sickness is discord as health is concord." A body that is suffering, is merely undergoing a penalty for violating the laws of health.

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* An *incantation* is the process of using certain formulæ of words and ceremonies, for the purpose of raising spirits or performing other magical actions.

† *Morbid* means not sound, or healthful; diseased; sickly.

‡ Fate.

In all cases when a person is ill, there has been some *cause* that brought about the illness. If that cause had not been in existence, no sickness would have occurred. Later on we shall see what the most important of these causes are, and learn the way to keep them from affecting us, or how to keep them under control. Some of these *causes* are so obvious as to require merely the exercise of a little common sense to remedy them, whilst others are so obscure that it has taken years of skilled inquiry to find them out, to learn what they are, how they affect us, and how to remove them.

The science which teaches these things is called *Hygiene* or *Sanitation.* The term *hygiene* is derived from Hygiea,* the name of the daughter of Æsculapius, the God of Medicine of the Ancient Greeks. Amongst these people Hygiea was considered to be the Goddess of Health. The word *sanitation* comes from the Latin *sanitas*, which also means *health.*

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* A Greek word meaning *health.*

Benefits of Hygiene.—The study and practice of the subject of *Public and Private Health* have done a vast amount of good in the civilised world. They have saved millions of lives, prolonged others, and lessened misery and want. Let us take a few instances to illustrate the benefits derived from the study of hygiene. None can shew them better than the great decrease in the extent and number of small-pox epidemics since the practice of *vaccination** in European countries has been properly carried out. Formerly, small-pox killed thousands of people in England almost yearly, and when it did not kill outright, it affected the patient in other ways. About one-fourth of the people living were disfigured from its ravages ; many of the unfortunates attacked became completely blind from the disease affecting the eyes. About one hundred years ago it was discovered that cows occasionally suffer from a disease of the udder, like the pustules of small-pox. It was further learnt that if the matter from these pustules be removed and placed on the broken skin of a man, woman, or child, it either prevented small-pox occurring at all, or, if it did occur, caused it to appear only in a mild form, as a rule. The disease in the cow is called *cow-pox*, and is transmitted to man by the process of *vaccination*. This is a trifling and harmless operation ; it is simple and almost painless.

At one time, large districts in England were very *malarious*, giving rise to *Ague* and *Dysentery*. These diseases have now almost entirely disappeared from

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* *Chichak ká tíká* (Hindi) ; *tika nikalna* (Urdú).

England. The disappearance is due to the improved drainage of the land lowering the water in the ground;[*] and one of the chief factors in producing ague was thus found out and removed.

During the Middle Ages, the "*plague*"[†] swept away millions of people in civilised countries. No such disease is met with to-day in Europe, although it occurs in a less virulent form in some of the towns on the east side of the Mediterranean Sea. It was ascertained that this dreadful disease was caused by the overcrowding of people and houses, by bad supply of air to houses or bad ventilation, and by accumulation of filth in and around human habitations. These hygienic defects were, to a large extent, remedied, and the plague, in its original form, disappeared from Europe.

Leprosy,[‡] after prevailing in England for thirteen centuries, has now ceased to exist there. Why it has quitted is not quite so readily explained as are the other instances quoted. It may be that its cessation is due to improved drainage, increased cultivation, better food, and better sanitation generally. To whatever causes it was due, those causes have now ceased to exist in England, but continue to prevail in India and other Eastern countries.

Scurvy, a disease formerly very fatal to soldiers in war and sailors at sea, is now avoided by the use of proper vegetable food, fresh meat, and lime juice.

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[*] This ground water is also called *sub-soil* water

[†] Or *mahamuri*.

[‡] Or *juzam* (Arabic).

The cause here was likewise ascertained, and the prevention of the disease made practicable.

WHAT IS HEALTH ?—By being in *health* we should understand that every part of our body is performing that work which Nature intended it to carry out. The heart, the brain, the lungs, the skin, the liver and other digestive organs,* the muscles, &c., are all carrying out their appointed office properly. In health we eat, drink, breathe, sleep, take exercise (both mental and bodily), do our daily work, and we enjoy all these things.

Disease, on the contrary, is a state where the allotted work in one or more parts of the body is not carried out as it should be. An infant in health is full of baby-mirth, has a ringing and hearty laugh, and shews delight in most things around it. When ill, it lies down, becomes cross, restless, fretful, refuses its food, and is a source of great trouble and anxiety to its parents.

VALUE OF HEALTH.—The body is the agent which the mind uses. If it is out of order, the effects of the best labour will be impaired. The best gifts of intellect or fortune are of little use, if the body be not healthy to use and enjoy them. The lazy alms-seeking mendicant with health is really happier than a rich man constantly suffering from disease. A weak or diseased habit of body places its possessor at a disadvantage in the race of life. On the other hand, strength and health of body bring with them vigour, force, and energy.

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* An *organ* is a portion of the body designed for a particular use, which use is called its *function* : thus the heart circulates the blood, the liver forms (or more properly *secretes*) bile.

CONSEQUENCES OF SICKNESS.—What miseries are created when the father of a poor family is laid up from ill-health! He either cannot carry out his daily work, or, if he does, it is with pain and weariness. Consider what distress it gives his family to behold him in this state. If he is a poor man, during his illness, his family is deprived of even daily bread. If either a father or mother dies under such circumstances, the poor orphans may be too young and helpless to take care of themselves. During illness a doctor may have to be paid, and medicines and special kinds of food bought to cure the disease. All this may be due to the original cause of the disease not being kept at a distance or removed.

Amongst rich people, a number of illnesses are due to eating and drinking too much and having no regular employment. They often lead sedentary lives. Those so circumstanced, when ill, suffer quite as much as the poverty-stricken. They may be constantly requiring a doctor: their life is rendered miserable by disease. On the other hand, the hard-working ploughman, blacksmith, stone-mason, or coolie when in health, enjoys his life and his work.

PREVENTION OF DISEASE.—A large proportion of the ills which affect us and rob us of so much time and pleasure are avoidable. A proper knowledge and observance of hygienic laws considerably decrease the number of the diseases from which we suffer. There are parts of England where one-half of the children die before they are five years old. There are likewise certain parts of some towns in India in which even this high mortality is exceeded. We are able to shew that at least three-fourths of these lives could be saved by following the dictates of the simple laws of health. About two millions of people die annually in the Indian Empire from preventible disease. Science has taught us how to prevent many diseases, by pointing out the causes of these maladies. If we extinguish the cause, the disease cannot come into existence.

CURE OF DISEASE.—In the cure of disease the first step is to obey the laws of health that have been broken. If medicine be used in disease, it is not altogether to destroy the disease itself, since disease is not a thing to be destroyed. The object of the medicine is chiefly to hold the deranged action in check while Nature repairs the injury and restores the functions of the body to their normal condition. We must never forget Nature's power to heal, and we should ever keep in mind the motto, that "prevention is better than cure." Although we ought to have a certain amount of confidence in the power of medicine to cure and relieve disease, we should place our dependence chiefly upon sanitary measures, whereby we may altogether prevent sickness.

MANKIND MORE LIABLE TO DISEASE THAN LOWER ANIMALS.—Of all the creatures of the Animal Kingdom, man possesses the highest order of intelligence and judgment; yet, is it not surprising that he should be the one that least frequently lives to the natural term of his existence? The allotted years of man are said to be "three score and ten;" yet in England (the country where sanitary science and knowledge of the nature of disease have most advanced) the average length of life is but 42 years. In India it is even shorter. The domestic animals that surround us, are comparatively much longer lived than we are; they live to the full term of their life with as much certainty as we do to a little more than half our natural term. The length of the life of the dog is said to be 16 years, of the domestic cat 10 years, of the guinea-pig 7 or 8. In each of these cases, if existence is not cut off by accident, the animal, as a rule, does not die until it has run its full term of life. Why is man more liable to disease and premature death than the lower animals? There are several points to be considered in explanation of this question. Man's very intelligence frequently leads to insanity;* he suffers from contagious† and infectious diseases from which the lower animals are to some extent exempt; he suffers from a large number of diseases arising from human vices; he suffers from indulgence in certain luxuries which his ingenuity and skill have created, and which are of a fatal nature. He is also liable to be affected by hereditary taints, and suffers from accidents due to his various callings. Lastly, human beings by their skill in constructing houses, cities, and towns for themselves, for protection from the changes of the elements, have, at the same time, created a number of mortal diseases. In ancient times, when large communities began to be formed and towns to be built, the results of man's own work could not be foreseen. We are now acquainted with the nature of the evils brought about by the bad work done in house and town construction in bygone times. It is our duty to remove all these evils, and to avoid adding to them. The chief defects of old towns arose from their narrow streets preventing free ventilation,* density of houses leading to overcrowding, deficient or defective drainage causing human refuse to remain and putrefy in and around their habitations, and the absence of provision for proper water supplies.

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* Unsoundness of mind or madness.

† Contagious diseases are those caught by contact, by the breath, &c.

CAUSES INTERFERING WITH SANITARY REFORM IN INDIA.—Sanitary reform is advancing throughout India, but its progress is somewhat tardy. Why should this be so? The reasons are mainly,—(1) ignorance of the people in regard to the subject of sanitation generally; (2) indifference to matters which they know must affect health; and (3) the firm hold that long-standing customs and prejudices have upon them, which leads to an unwillingness to change their habits.

INFLUENCE OF DOMESTIC SANITATION AND PERSONAL HYGIENE.—With such barriers before us, how are we to meet these difficulties? As far as the individual is concerned, the reply to this question is—By *attention to Domestic Sanitation and Personal Hygiene.* In these few words the problem is solved in the main. All communities of towns, cities, and villages are made up of a number of individuals. If every person in each community did that which kept him constantly in health, disease and mortality would rapidly decline. But no race of people has as yet arrived at this ideal state of sanitary perfection. In India the unwholesome and filthy habits of bygone generations have been continued by succeeding generations. Education is now, however, spreading its influence far and wide, and through it the people are taking some interest in the subject before us.

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* *Ventilation* is the process by which fresh air is supplied and foul air removed.

The unclean customs of any one person do not harm himself alone: they likewise affect his neighbours. What affects one individual may, eventually, affect the entire population of the town or villages in which he lives. Take, for instance, an epidemic of small-pox. This starts by attacking one person only, but it may spread from him to thousands. Now, had such a patient intimated to the sanitary authorities at once that he was affected with this loathsome disease, arrangements might have been made for his separation from other people, and thereby the spread of the disease would have been prevented. The same may often be said of cholera and many other diseases. On the other hand, if there is one person only in an inhabited locality who leads a healthy life, it is so much gain to the people. If all lead healthy lives, the greatest possible benefit accrues to the public health. It has been truly said that "a large and healthy population is the life and strength of a nation, and the source of its success in science, art, agriculture, and commerce." Therefore, any person offending against the laws of health is an enemy to himself and the enemy of the people amongst whom he lives.

SANITARY LAWS AND RULES.—It must be understood that whenever large masses of people are gathered together, the causes of disease are constantly in existence, and unless these causes are removed they tend to increase. Under such circumstances the natural conditions of existence are disturbed. People do not perceive this abnormal state of things until some fearful outbreak of sickness arises and causes great loss of life. It is from the effects of epidemic diseases, occurring in crowded towns and communities, that modern sanitary science may be stated to have had its birth.

The greater the number of people in a place, the more is the need of careful attention to sanitation. At the present day, in most civilised countries, Sanitary Laws are in existence, which have for their object the protection of the health of the individual as well as that of the masses of the people. Persons indulging in habits or practices forbidden by these laws become liable to punishment. These laws are drawn up with the utmost care. We now see the necessity of paying respect and obedience to them.

We should submit to them with the same willingness that we do to any other of the laws of the realm. For instance, it is no injustice to prevent a person draining a filthy cesspit or *sundass*[*] on to the public road. The prevention of such a custom should not be thought a hardship. Under sanitary laws the health and prosperity of millions of people in India and elsewhere have improved. The greater the mass of people, the greater the need of sanitation, and the more need is there that this sanitation be placed under some controlling authority: hence the existence of Municipal Corporations in the different towns and cities of India.

We have already mentioned that *Domestic Sanitation* is of great importance. In it is implied much that we shall have occasion to refer to later on, but before writing about the particular items in domestic sanitation that affect our health, there are certain principles which guide us in house hygiene which might be here enumerated. These are—

(1) That the house we live in should be properly constructed; that in this construction proper materials should be used; that it should be so built as to allow sufficient light and air to enter it.

(2) That everything found in the house (whether it be human filth, dry rubbish, slops, or aught else) of an offensive and harmful nature, should be removed to a distance

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[*] A *sundass* is a well privy, usually situated in the occupied house, or in its immediate vicinity.

from human habitations to prevent disease-causes arising.*

(3) That a sufficient supply of wholesome water be provided.

To keep in health, then, we should be attentive to the conditions under which we live—the nature of the food we eat, the water we drink, the house which we inhabit, and the surroundings of that house.

A story is told of a deaf boy who was asked in writing: "What is health?" His reply was: "A pleasant life." Health is the greatest blessing that can be conferred on mankind. It is a constant source of enjoyment. We feel this specially after recovering from a very painful illness. During the illness, life is considered a burden—we are miserable and discontented; on recovery we are reminded of what a pleasure it is to possess good health.

It cannot be too forcibly impressed upon us that most diseases are due to carelessness or ignorance, or both. The careful perusal of this little book will, it is hoped, help to disperse the mist of ignorance that prevails on sanitary matters in most parts of India, and causes the people to cast aside their prejudices, and do those things that Health Science shews are for their good.

We may now split up our subject and deal with each branch of it separately, beginning with the most important one—the subject of *Air*.

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* We should remember that *dirt is the parent of disease*; it works against health, energy, and purity, both of mind and body. A wise man has said that "dirt is matter in the wrong place." The great point for us to regard is to keep dirt away from our bodies, our houses, and our surroundings. By so doing we go a long way to ensure the maintenance of good health.

CHAPTER II.

AIR.

Inspired Air should be pure—Organs of Respiration—How we breathe—Composition of the Air—Composition of the Air we expire—Carbonic Acid Gas—Animal matter—Effects of re-breathing Air—Use of the Sense of Smell in recognising Foul Air—Other ways in which Air is rendered impure—Uniform Composition of Air.

THE body requires food, drink, clothing, and sunshine, but none of these requirements are so urgent as that of air. The other demands may be met by occasional supplies, but air we need always. We cannot live without breathing, that is, taking air into our lungs. From the moment we are born to the moment we die, we are breathing. If entirely deprived of air for a few minutes only, we should die. It is the most important agent to maintain existence. This we may prove in a very simple way. Take a little bird, put it under a glass jar, and then remove the air from the jar by means of an air pump: the bird at first faints, and then dies; but if we let in air again, just after the little animal has fainted, it will recover.

INSPIRED AIR SHOULD BE PURE.—Besides requiring air, we must have that air *pure and fresh*, and not mixed with any foul gases. Air may be stagnant, dirty, poisonous, putrid, or stale. We shall see how these various bad qualities are imparted to it. We must do our utmost to get a proper supply of good air. More sickness is due to impure air than to any other single cause with which we are acquainted.

Before we can properly understand how impure air affects us, it is neccessary to have some knowledge regarding the anatomy* and physiology† of the organs of respiration.

ORGANS OF RESPIRATION.—The chief organs of respiration are the *Larynx*, the *Trachea*, and the *Lungs*.

The Larynx is the organ of the voice. In shape it is somewhat like a small triangular box, situated in the upper and front part of the neck, between the mouth and trachea or windpipe, and just behind the tongue. It is chiefly composed of simple gristle or cartilage. There is an opening in the larynx called the *glottis*, which is slit-like in shape during expiration,‡ and large and triangular during inspiration.§ This opening is guarded on the top by a thin piece of elastic cartilage, called the *epiglottis*. This latter is a spoon-shaped lid, which opens when we breathe, but, by a very pretty arrangement, shuts when we swallow and so lets our food glide over it into the *œsophagus* or *food-pipe*, and then into the stomach.

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* *Anatomy* is the art of dissecting or artificially separating the different parts of any organised body to discover their situation, structure, and economy.

† *Physiology* is the science which treats of the nature and constitution of living bodies.

‡ *Expiration* is a breathing out or expulsion of air from the lungs, through the mouth or nose, in the process of respiration or breathing.

§ The act of drawing in or inhaling air into the lungs: opposed to expiration.

The position of the larynx in the neck is marked by a prominence in the middle line, below the chin, which is popularly known as "Adam's apple."

The Trachea.—Below the larynx is the trachea or wind-pipe. This is an elastic tube, strengthened by C-shaped rings of cartilage embedded in softer tissues; the incomplete part of the C is behind. The food-pipe is attached to, and placed behind, the trachea, and runs almost parallel with it. Shortly after entering the cavity of the chest, the trachea divides into two smaller tubes, called the right and left *bronchi*, which still further sub-divide and pass into the substance of the lungs, like the branches of a tree. At length, these very small *bronchial tubes* end in clusters of extremely small and fine *air-cells*. The tissue composing the walls of these cells is very delicate and elastic. The air-cells give the lungs their sponge-like character. The stiff cartilaginous rings of the trachea and bronchi disappear gradually as we approach the smallest bronchial tubes. This arrangement allows the larger bronchial tubes to be constantly open, whilst the smaller, being elastic and containing muscular fibres, can vary their diameter.

The Lungs.—The lungs are surrounded on their outside by a double covering of a fine delicate membrane called the *pleura*, one layer of which is attached to the chest wall, the other to the lungs. The pleura secretes a fluid which permits these two layers to glide on each other with ease during respiration. The ramifications of the bronchial tubes and the air-sacs are lined with *mucous membrane*, which is very delicate and sensitive to the presence of anything except the air. If the inspired air contains many particles of dust, these latter excite coughing, and by this means we get rid of the offending bodies. Along the lining of all parts of the air-passages, as far as the air-cells, are minute filaments of protoplasm* called *cilia*, which are in constant motion, like a field of grain stirred by a gentle breeze. "These cilia serve to fan the air in the lungs, and to produce an outward current, which is useful in catching dust and fine particles swept inward with the breath."

The air-sacs which we have mentioned form the true substance of the lungs, and they are much smaller than the pores of an ordinary sponge. Their walls are very thin, and contain a large number of minute blood vessels called *capillaries*.† The air-sacs are so hollowed out that a single wall separates two adjoining cells. The air taken into the lungs enters them, and, from the thinness of their wall, comes almost into contact with the blood vessels, there being only a very thin film of membrane between them. A number of the waste, useless, and harmful things the blood does not require, are sent off through this thin membrane ; and, on the other hand, the blood abstracts from the air that which it wants, namely, *oxygen*. The oxygen so taken up by the blood is conveyed through the left side of the heart to the different parts of the body. Here it loses some of its oxygen, for the tissues* are hungry and take it as part of their food. But the tissues, in removing the oxygen from the blood, give to it in return their waste matters and bad products, which are carried back to the lungs, and are largely given out to the air in the air-sacs, to be exhaled. It is by this beautiful and natural contrivance that the blood is changed from being dark red and impure, to bright red and pure. It is only in this bright condition that it is fit to nourish the tissues of the body.

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* The viscid nitrogenous material of animal and vegetable cells performing various functions—secretion, excretion, growth, &c. The term is generally applied to the granular contents of cells, and to the "germinal matter" which constitutes the "physical basis of life."

† *Capillaries* are the tiny ramifications or branches of blood vessels terminating on the surface of the body, in the substance of solid organs or in internal cavities. They are situated between the arteries and veins.

HOW WE BREATHE.—By breathing, we cause the air to enter and leave the chest. The air is conveyed into, and from the lungs, by means of the wind-pipe. Each respiration consists of two acts—*inspiration*, or taking the air into the chest; and *expiration*, or expelling it.

Inspiration.—When we draw in a full breath, we unconsciously straighten the spine and fix the head and shoulders, so that the muscles that expand the chest may act to the greatest advantage. At the same time, the *diaphragm*† descends and presses the walls of the *abdomen*‡ outwards. By these means the size of the chest is increased and the elastic lungs expand to occupy the extra space; while the air rushes in along the wind-pipe and bronchial tubes, and reaches the air-sacs.

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* *Tissue* is a general term applied to the textures of which the different organs are composed—Osseous tissue forms bone; fat cells form adipose tissue.

† A broad muscular partition between the chest and the abdominal cavities.

‡ The cavity that contains the organs of digestion.

Expiration.—If we forcibly expel the air from the chest, the operation is reversed: we bend forward, draw in the abdominal walls, and the diaphragm ascends; all, together lessening the size of the chest cavity and sending the air from the lungs.

At each breath an adult inspires 25 or 30 cubic inches of air, but a much larger quantity may be inhaled. If an adult takes a very deep breath and then forcibly drives the air from the lungs, we get what is known as the *breathing capacity*, which, in a man 5 feet 8 inches, is 130 cubic inches, or about a gallon.

Composition of the Air.—The air may be considered to consist of an ocean of mixed gases that surround the world. This ocean is about 50 miles deep. It is really much deeper, but beyond 50 miles from the earth, it becomes very thin or rarified. The lowest layer, or that which we breathe, is much heavier than the layers near the top. Air is invisible, and we are only made aware if its presence when it is in motion* or when we are moving against it. Air is composed mainly of a mixture of two gases,† one called *oxygen* and the other *nitrogen*.

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* Air in motion is called *wind*.

† All things in the world belong to one of three classes—solids, liquids, or gases. *Solids* are bodies that have a fixed shape and possess a certain amount of hardness, such as a

Ordinary air always contains a few other agents, of which the chief are *carbonic acid gas*, *ammonia*, and *watery vapour*. The carbonic acid gas and ammonia are in such small quantities as not to affect the qualities of the air for human respiration. Neither of them serves any useful purpose in the animal economy, but they are of immense use to plant life. The ammonia* of the air supplies plants with part of the nitrogen they require as food. The carbonic acid is to the Vegetable Kingdom what oxygen is to the Animal—a necessary food. Plants breathe just as animals do, only they reverse the process: they take in the carbon of the carbon dioxide and set free the oxygen. When oxygen and carbon are united with one another to form carbonic acid gas, we are not able to utilize either of these elements. Plants, on the other hand, *are* able to split up the carbonic acid gas into their component simple bodies. When the sun shines on the green colouring matter of leaves, it causes it to pick out the carbon of the carbonic acid gas of the air and sends back the oxygen for us to breathe; plants, therefore, help to purify the air; further, the carbon that the plants have taken in is so changed and joined with other

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piece of wood or stone or metal. *Liquids* are agents that have no constant shape; they take the form of the vessels that contain them. *Gases* are bodies that have no fixed shape, and always tend to increase in volume. All three classes are made up of minute invisible particles called *atoms*. In a gas every atom is trying to drive away the neighbouring atom.

* *Ammonia* is a gas composed of one atom of nitrogen and three atoms of hydrogen.

bodies in the plant, as to make it fit for us to take as food. At night most plants reverse the order of breathing; they take away the oxygen and give off carbonic acid gas, but, on the whole, they give out much more oxygen than they take up from the air. The carbonic acid gas itself, being usually in comparatively small quantities in the air, is not poisonous. In inhabited houses, however, it is accompanied with a certain quantity of the noxious animal matters and foul organic gases given off by the lungs. When the carbonic gas is in excess, the animal matter is in excess also. Exact and scientific observations have proved that the amount of carbonic acid gas contained in an inhabited room, corresponds with the amount of impure animal organic matter contained in that room. The amount of carbonic acid gas in the air is, therefore, taken as a measure of the purity of the atmosphere in our rooms. Excess of it in air tells of excess of respiratory animal impurities.

In and around inhabited places, the air contains many impurities, chiefly in the form of foul gases, dust, particles of animal and vegetable matter, and frequently the germs of disease.

Oxyen and Nitrogen.—One hundred parts of air contain about 79 parts of nitrogen and 21 of oxygen, or roughly four of the former to one of the latter. The oxygen is much the more important of the two; it is the vital element of the atmosphere, and is a very active gas, which serves the purpose of keeping our blood pure. Oxygen combines with other bodies and burns them up. Without it we could not produce light or heat from any combustible substance, nor could life be supported. Inside our bodies oxygen also burns, but the burning goes on so slowly that we do not feel the heat it produces: this is the chief way in which our bodies are kept warm. Oxygen is so active that if the air contained only this one gas, it would burn us up and we should die. If we put a lighted candle in pure oxygen, it burns very brightly and wastes away much more rapidly than if we put it in ordinary air. But if we deprive the air of its oxygen, and put a lighted candle into the remaining nitrogen, the candle goes out at once. Nitrogen is a harmless gas: nothing will burn in it. Animals would die at once if they had only nitrogen to breathe. The oxygen alone is far too strong for us to breathe. The nitrogen is mixed with it to make it weaker or dilute it. Nature has provided a mixture of these two gases in such proportion to one another, that the air can be breathed by men and animals, and lamps and fires can be kept alight in this mixture of gases.

COMPOSITION OF THE AIR WE EXPIRE.—We now know what ordinary air contains. Let us see what air given off from the lungs contains.

Watery Vapour.—One of the things given off from the lungs is *watery vapour.* An adult, in 24 hours, gives off from 9 to 11 ounces of water from the lungs. In the cold weather we can see clouds of steam coming from the mouth. This visible vapour is water in a finely divided state. We can also prove that this steam leaves the mouth by breathing on to the front of a looking-glass. By doing this, we notice that the mirror becomes damp directly. The air we inhale contains a small and variable amount of water, but the air we exhale always contains as much water as it can hold in the state of vapour, or steam. The expired air is, therefore, said to be *saturated* with watery vapour.

CARBONIC ACID GAS.*—We also breathe out carbonic acid gas, which is colourless; but we can readily prove that it is present. Get a bottle containing some clear *lime water*† and breathe into it through a glass tube. We notice that the clearness of the lime water disappears—it becomes milky. This change is effected by the carbonic acid gas uniting with the lime of the lime water, to form fine particles of *chalk*. Or, breathe into a jar, and lower a lighted candle into it. We will find that the flame is instantly extinguished, showing the presence of carbonic acid gas. Ordinary air contains a little carbonic acid gas,‡ expired air contains much more.§

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[*] Carbonic acid gas is made up of oxygen and carbon. We have learnt something about oxygen already. If we burn a piece of wood closed in a case so that very little or no air reaches it, the wood turns black. This dark mass is called *charcoal*, which is almost all *carbon*. Now when this carbon combines with abundance of oxygen, *carbonic acid gas is formed*.

[†] *Choona pani.*

[‡] Four parts in 10,000.

[§] About 120 times as much. In this manner a man in twenty-four hours sends off from his lungs as much carbon as is contained in a piece of charcoal weighing eight ounces.

Neither the watery vapour, nor the carbonic acid, is poisonous, but they are in company with other bodies which are very poisonous. Some watery vapour is always contained in the air, and a certain amount of it is beneficial, both for animals and plants. If in excess, as it is in Lower Bengal and most sea-coast towns in India, it makes the climate relaxing.* If very small in amount, it makes the air dry, thereby causing too much evaporation from our bodies and from plants. Very dry air is injurious to plants.

ANIMAL MATTER.—We also breathe out minute particles of animal matter, and several varieties of organic gases, which are all ready to decay and putrefy. It is this putrid animal matter that is so noxious in air that has once been breathed. Many years ago, when houses and jails in England were more densely crowded with people than they are now, outbreaks of "plague" and typhus fever arose. It is believed that the chief cause of these outbreaks was the impurity of the air from the decomposing animal matter and organic gases exhaled from the lungs of human beings. Recently, this animal matter was isolated in a crystalline form by a chemist, and it was found that very small quantities of it were capable of killing dogs and rabbits. If you

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We are unable to see the carbon, because it has combined with oxygen to form carbonic acid gas, which is colorless.

* Relaxing climates are such as produce a want of general vigour, and cause the various functions of the animal economy to be carried on sluggishly.

confine the expired air in a bottle for a time, th animal matter decomposes and gives out an offensiv odour.

EFFECTS OF RE-BREATHING AIR.—By breathing, w rapidly spoil the air. If we are shut up in a plac where the good air from outside cannot enter, an the bad air from within cannot make its exit, w soon become ill; and if we remained long unde these conditions, we should die. We have all, perhaps, heard of the Black Hole of Calcutta. Thi was a small room in which 146 persons were plac for a whole night, the room having but two tin windows, which were closed. During the night, th people suffered intense agony, and in the morning onl 23 of them were found alive, the other 123 having die from the bad effects of air that had been breathe over and over again. In another instance whic occurred at sea, a ship was exposed to a heav storm: the captain of the vessel sent all th passengers to their cabins, and closed all the door ports, and skylights, so that no fresh air could ge into the cabins. Many of the passengers died fro breathing the air that had been rendered foul an poisonous by previous respiration.

Short of producing actual death, the constan breathing of air rendered slightly impure by previou respiration, tends to undermine our health. Th blood is then not purified, and in this impure stat is ready to receive the germs of disease at any tim It is this condition of the atmosphere of our room that begets the general languour of which people so frequently complain. This it is that frequently gives rise to headache, loss of appetite, nausea, pallor, and a general want of vigour. It further produces a closeness and stuffiness of the air in our rooms, and lessens the activity of the mental processes. If proper means are not adopted for getting rid of this foul air from bed-rooms, we wake up in the morning feeling very lazy, heavy, unrefreshed, and disinclined for our day's work, instead of being fresh, brisk, and active.

USE OF THE SENSE OF SMELL IN RECOGNISING FOUL AIR.—The foul animal particles and organic gases are themselves invisible, but we can recognise them by the sense of smell, and also by the effect they produce on us if they are present beyond a certain ratio. Particularly can we notice their presence if we come into a room after being in the fresh, open, air. They cause the air to be close, stuffy, and disagreeable. Our sense of smell ought to protect us from the evils connected with the breathing of foul air. It is this organ also which tells us of bad food and filthy odours generally. If we neglect the sense of smell we find that it soon gets blunted, and at length fails to tell us that these dangers are near. As with most other things, people get accustomed to bad smells, and then the poisonous gases and putrid animal matter in the air do not *appear* to be so harmful to them as they were at first. A little experiment teaches this. Get a bell jar, and put a little bird into it; keep the bird there for about half an hour and we find that it dies after a certain time. But if, before it dies, we put another bird into the jar, the second bird dies in half the time. This shows that the first bird had become accustomed to the foul air it had breathed over and over again. The same occurs with human beings. Of our five senses, that of smell is the easiest to get out of practice. People neglecting bad smells, after a time actually do not know that any offensive odours are present. Were some people to perceive the bad smells that surround them, they would not live in the dreadful places they do. By the proper education of the nose, we can at once tell when there is some impure matter in the air. Knowing that some impurity is present, if we wish to keep healthy (and who does not?), we at once try to get rid of the bad smell, from whatever source it has arisen, in order that the air we are breathing may remain pure.

Such foul air as we have been describing makes the blood impure, and impure blood is harmful to every tissue and organ of the body. Air fouled by respiratory impurities breeds disease and leads to death; hence the necessity of constantly breathing pure air.

OTHER WAYS IN WHICH AIR IS RENDERED IMPURE.—Besides the fouling of the air produced by human respiration, air may be rendered impure in several other ways:—

(1) *Burning of lamps and fires* renders the air impure. When an oil lamp or candle is burning, it

gives off water, carbonic acid, and some complex bodies which give the smell we notice. A lamp will not burn in the absence of oxygen. It uses some of the oxygen of the air we should get. Enough air should be supplied, then, for ourselves, the lamps, and any fires situated in inhabited rooms.

(2) When *animal or vegetable matter is decaying*, it gives off foul gases, which mix with the air and are inhaled by us. The sense of smell should enable us to detect these bad odours, and lead us to remove whatever created them. We should not leave bits of stale meat, or the leavings of a meal, skins of vegetables and fruits, mango stones, or sugarcane refuse in the house. Get rid of such things at once.

(3) *Cooking in inhabited rooms* gives a sense of heaviness to the air breathed, and takes away the appetite.

(4) *Clothes should never be washed in rooms:* the splashings from this process cause the foul water to soil the room and its air, besides making it damp.

(5) *Dirty floors, dirty furniture, and dirty walls*, give a peculiar nasty smell to the air. Dirty clothes, boots, and shoes, also give out offensive odours. All inhabited rooms and their contents should be kept clean. This is largely assisted by keeping the doors and windows open, which, in addition to letting in air, gives access to *light*, which *shews where the dirt is.*

(6) *Badly constructed drains, and the absence of drains*, also add greatly to the impurities of the air in and near houses. If ever we get a smell from a drain, it is poisonous gas that produces it. This

smell may be removed and prevented by flushing all drains, in and around the house, regularly with water. If the drains are clean, and yet these bad smells arise, the cause is due to pollution of the soil from decomposing and putrid animal and vegetable matter. Such smells cause many forms of sickness—especially fevers, sore throat, diarrhœa, dysentery—any one of which may prove fatal. But short of causing any serious disease, foul drains and putrid soil may bring on a feeling of undefined ill-health—just in the same way that a small quantity of arsenic may cause a certain amount of discomfort, yet a larger quantity will kill outright. Ground that is fouled by slops and house refuse, is constantly giving out bad gases. In the soil, as in our lungs, the air is constantly being changed. Pure air enters the soil, but in leaving it carries away foul gases, which mix with the air we breathe. Further, if the ground is moist (as it often is around imperfectly drained houses), the gases are damp as well as foul. Damp gases from decaying vegetable matter are the principal causes of *malarial fevers*. It is very necessary to have proper drains attached to each house, so that all waste and refuse fluids are at once conveyed to a distance from the dwelling.

(7) *Butchers*, *leather-makers*, *curers of animal skins*, *dyers*, and others, frequently carry on their trade in the heart of inhabited places. In all these trades a refuse of animal or vegetable matter is left, which rapidly putrifies, and in this putrefaction offensive gases are evolved and inhaled by us. Such

people should be compelled to carry on their business on the outskirts of towns and villages, and, in all cases, should be forced to provide for the immediate or regular removal of all trade refuse.

(8) *Sick people give off bad gases* and other foul bodies, which may be direct poisons. These foul gases are of a more harmful nature, and greater in quantity, than healthy people give off. Many diseases are due to the entrance of minute invisible vegetable germs into the body. Nature tries to throw off these germs either by the lungs or otherwise. If they once find their way into the body, some descriptions of them may rapidly multiply. Such seeds or germs come away in great numbers from the bodies of persons suffering from small-pox. The germs of small-pox are then diffused through the air of the room occupied by the patient, and if we inhale them, and have not had small-pox before, or have not been properly vaccinated, they are likely to give us the disease. These remarks apply equally to such diseases as measles, mumps, chicken-pox, &c. Germs have been found in connection with all of these diseases.

(9) The air in and around graveyards is impure. Burial grounds should, therefore, be at a distance from human dwellings. The same may be said of the air near *brick-kilns*. The air of *marshes* and *jheels* contains the poison known as *malaria*, which produces fever, diarrhœa, dysentery, neuralgia, and enlarged spleen, &c. *Dust* containing all kinds of mineral, vegetable, and animal particles, frequently renders the air impure and irritating to the lungs.

(10) *Domestic animals*, such as cows, buffaloes, goats, dogs, sheep, &c., kept in and near houses, spoil the air, as we do, by breathing. They render the air impure also in other ways. Their droppings, if left on the ground (as they frequently are, for a time, at least) decay, and the foul gases given off in the decaying process pollute the air. Further, when this manure dries up, it crumbles to powder, which mixes with the air we breathe. We see the necessity then of keeping cows, horses, and other such domestic animals in properly made stables or sheds, at a distance from the houses we inhabit. These sheds should be kept clean.

Lastly, and perhaps most important of all, is the impurity of the air brought about by the *accumulation of human ordure in and around houses*. The gases given off from foul privies are not only disgustingly offensive, but are dangerous to health. Latrines, therefore, should always be kept properly constructed and clean.

UNIFORM COMPOSITION OF AIR.—We now know the chief ways by which the air is made impure. We also know something about the composition of the air. Notwithstanding all the foul matters added to air, it remains much the same in composition, and this uniformity is another wonderful provision of Nature; for, if the air became gradually more impure, we, and all the animal creation, would soon die. We will soon inquire into the factors that are constantly at work in keeping up this uniform composition of the air.

CHAPTER III.

VENTILATION.

Ventilation of Sleeping-rooms—Ventilation of Schools—Summary of the foregoing pages on Air and Ventilation.

ONE of the great principles of sanitation is to get rid of whatever comes away from the body as soon as possible, be it air fouled by breathing or the waste matters from the surface of the body—fœces or urine. This is the most important point put forward in these pages, and attention to it will improve our health and welfare.

This principle directs that we should get rid of the air we have made impure, by breathing and otherwise, as quickly as practicable. We get rid of this foul air, and supply ourselves with fresh air, by what is called *Ventilation*, which means the bringing in of wind. Ventilation teaches us how to remove or dilute the foul air of dwellings by a supply of good fresh air. It tells us how to get rid of the impurities that are given off from the lungs, skin, and body generally, as well as those that arise from vegetable and animal decay, combustion of lights and fires, and from cooking. Ventilation is usually divided into *Natural* and *Artificial.*

Natural ventilation is effected by the forces of nature, and *artificial ventilation* is carried out by appliances and arrangements manufactured and used by man to aid these natural forces. There are three factors at work in producing aërial currents. These are,—(1) the property possessed by all gases of diffusing or mixing with each other;* (2) the fact that warm gases are lighter than cold, and therefore ascend;† and (3) the force of the wind. Let us consider each of these in detail.

(1) All gases mix with each other or diffuse: we see this by watching the smoke ascend from the chimney of a railway engine; it ascends higher and higher, and as it rises it loses its dark colour and becomes less dusky, because it mixes freely with more and more air or diffuses itself; finally, we see that the smoke seems to have disappeared altogether, and at this stage it has completely mixed with the air. That which gives smoke its dark hue is not a gas; it is minute particles of carbon, but these particles are mixed or in company with gases which diffuse freely in the air. In breathing, the same principle is in action. The gases, vapour, and animal particles we breathe out mix readily with the air and are diluted and the more air they mix with, the less harmful are they.

(2) The second factor in natural ventilation is the fact that *warm gases are lighter than cold and therefore ascend, and by ascending permit cooler air to*

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* This Diffusion of Gases is based on the well known physical principle whereby two gases tend to mix in exact proportions, no matter what may be the quantity of each.

† All gases expand about $\frac{1}{500}$ of their volume for every increase in temperature of 1° Fahrenheit.

take its place below by gravitation. The warm air rises and floats on the surface of the cool air, just as a cork floats in water because it is lighter than the water. The warm and bad gases in an inhabited room ascend towards the ceiling. If there is an opening at the top of the room, the foul air goes out by it and it is thus got rid of. If there is no such opening, however, the bad air gets cooler, becomes heavy and descends, and we are obliged to inhale it once more. It follows, then, that all houses should have openings in the upper part of the room to let out the foul air. In India exit of foul air is best ensured by having small windows placed near the roof.

This second factor is the main cause of the circulation of air in rooms. We can easily prove that it is always in action. Thus, if we open the door of a heated room in which there is no cross ventilation, and hold a lighted candle first at the top and then at the bottom, we can see by the deflection of the flame that there is a current of air directed outward at the top and inwards at the bottom of the opening. The smoke of a piece of burning brown paper, or burning camphor, in front of a fireplace or near a door or window, will indicate that a current of air is passing up the chimney or in or out the door or window. This is caused by the difference of temperature between the air in the room and the outside air. All ordinary ventilation depends on this difference of temperature.

(3) The third factor is that of the *wind.* It sweeps away the bad gases arising from things that

are decomposing, brings in a supply of good air, and so keeps the air of rooms fresh and pure. But the wind can only carry out this good office by our placing our windows and doors in such a position that it can gain entrance and exit. To get full advantage of it for this purpose, we should have windows and doors placed opposite each other in the room—or better, at an angle to one another—so as to ensure circulation of the air, and thereby prevent its passing directly in and out. But if the windows and doors are placed at an angle to the prevailing winds, they may be opposite one another. The windows should open directly into the outside air.

Having considered the natural forces engaged in ventilation, let us see how they are taken advantage of. All openings in a room communicating with the air, directly or indirectly, give entrance or exit to air. The chief of such openings are doors, windows, and chimneys. But all chinks and cracks in doors, windows, and walls effect the same object. Openings in the roof, such as exist in some ridge-roofed houses, do the same. Even brick walls allow some air to get through them, and thatched-roofed houses freely permit of air making its way from rooms.

We have said enough to show that every occupant of a house should be supplied with a sufficient quantity of fresh air.

Ventilation is perfect only when the air in a room is as pure as that out of doors. This could be effected with 600 cubic feet of space for every occupant, if the *best possible* arrangements for change of air existed; but such arrangements are rarely found, at least, in India. It often happens that, in the huts of the lower classes, scarcely half this amount of cubic space is provided for each person. A large number of women in India are obliged to live, the greater part of their lives, in one or two small ill-ventilated rooms. The *zenanas* of the poorer classes are as bad as dungeons. In them an unfortunate woman is confined to one small room day and night. As a rule, no provision is made for either ventilation or access of light. A few months ago we were asked to see a woman who was suffering from cholera; we found her occupying a room 6′ × 7′ × 6′, and in this small chamber three other women and her husband were crowded.

It is very necessary for the good of future generations in India that *gosha* or *parda-nashin* women should be provided with enough air and light. The present system tends to bring about a gradual lowering of the strength and vigour of such females, which renders them unable to go through the natural processes when offspring arrive. Further, such off spring are frequently puny and defective in development, and, under existing circumstances, become by degrees more so.

In the houses of well-to-do people in India, ventilation is a matter that looks after itself. Windows and doors are usually in sufficient numbers. In the houses of poor people, as we have already stated, this is not the case.

The object of ventilation is to provide enough fresh air without the creation of draughts. This can only be effected when the amount of cubic space* is sufficient. Air can only be kept in a state of purity when 3,000 cubic feet of air is supplied to each person every hour. The air in a room should not be changed more frequently than three times in an hour, otherwise draughts or perceptible currents of air are created. Therefore, 1,000 feet of cubic space should exist for each person. Such an amount of space, however, cannot always be furnished, but we consider that 400 cubic feet is the least allowable. Each person should have about 90 square feet of *superficial space*,† and under no circumstances should it be less than 48 square feet. The superficial space is not of very great importance so long as the air can be changed often enough to keep it pure; but if the air is changed too often it causes a draught, which may (especially in cold weather) bring about chills and fever. Even with a large superficial space, if there be not proper ventilation arrangements, the air remains impure; whereas with small surface space, if the ventilation arrangements are good, the air may be kept pure.

Even the small cubical space above-mentioned (400 feet) is rarely provided for each person in *bustee* huts. We see large families huddled together in one small room, and this occurs in the huts of entire areas, leading to dense overcrowding. It is now a well-known fact that people in over-populated places die much faster than those in less crowded localities.

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* *Cubic space* refers to the actual volume of air contained in the room. In rooms with the walls, floor, and roof at right angles to one another, the cubic space is got by multiplying the length, breadth, and height together.

† *Superficial space* means the extent of the flat surface of the room, and if the sides of the floor are at right angles, it is got by multiplying the length into the breadth.

VENTILATION OF SLEEPING-ROOMS.—It is very important that we should be supplied with good air in the room in which we sleep. If the quality of the air in the room occupied during the sleeping hours be pure, it must have a good effect on your system. It must be remembered that we pass about one-third of our lives in sleep. Some people close all their doors and windows at night during all weathers. By this the good air is shut out and the bad air kept in the room. The result is that the occupants get up in the morning feeling lazy, heavy, and disinclined for their day's work, instead of being fresh and active. If you go into such a room in the morning, before the sleepers are awake, you will at once find out why they do not feel well in the morning until they get some fresh air. By sleeping in a room where but little fresh air enters, foul air is being constantly breathed and re-breathed. We know that the animal impurities and carbonic acid gas thus inhaled are very bad for us. We should, therefore, always provide for the entrance of abundance of fresh air into sleeping-rooms, avoiding cold winds and draughts. This enables us to sleep better, and to awake refreshed, brilliant, and happy. We must keep our bodies warm with bed clothes, if necessary, to avoid chills. In all cases where there is a top window or ventilator in the room, it should be opened at night.

It is necessary also that the room or rooms occupied *in the day-time* be supplied with plenty of fresh air. During the day we are for a certain period outside our houses and in the open air. Except in the very hot weather, the doors and windows should be opened during this time.

All houses should have an open space both in front and behind, and the doors and windows should, if possible, face in the direction of those spaces; a good rush of air is thus obtained to remove all impurities of the internal atmosphere.

If we are careful to provide for the bad air getting out of the house, the good air must enter; and if enough of it enters, there need be no fear of the evil effects of foul air.

Our chests should not be in any way constricted by tight jackets, waistcoats, or coats; for these tend to lessen the quantity of air taken into the lungs.

Certain trades conduce to lessen the quantity of air respired. Tailors and shoemakers are examples of this, who, from the stooping position in which they carry out their work, inspire less air than other people. Some trades cause lung diseases, from particles of the material worked finding its way to the lungs. Such is the trade of the stone-mason and of the spinner. These latter artisans might protect themselves by *respirators*.*

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* A *respirator* is an instrument used for covering the mouth, and consists of a fine network of wire in front, through which persons can breathe. It filters solid particles of dust, &c., contained in the air to be inspired.

VENTILATION OF SCHOOLS.—The worst effect from *stooping*, however, is brought out in *children at school.* They are kept at their books in a constrained and stooping position for hours. This lessens the amount of air they inhale, and, by decreasing the supply of oxygen, hampers their growth and formation, besides leading to deformity of the chest walls : add to this that in most schools a multitude of boys or girls are crowded together in rooms much too small for the number, and we thus have decrease in quantity, and defect in quality, of the air. In going into a school-room shortly before it closes in the evening, we may at once notice the disagreeable, and sometimes stifling, odour that pervades it. Many causes are at work to produce this. The *insensible* perspiration* is very active in children ; they rush into school with their clothing wet with ordinary perspiration induced by their play, so that each pupil serves to impart about half a pint of watery vapour to the air. Children often come from homes that are close, dirty, badly ventilated, and often occupied by the sick, bringing in their clothes the germs of disease. Some of the pupils themselves may be suffering from disease, and not know it, so that the poisonous exhalations from their skin and breath are breathed by other children. The children bring in dirt on their feet or shoes, which dries up, pulverizes, and floats in the air. Particles of chalk also fly about the room.

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* Under ordinary circumstances, especially during the cold weather, no liquid water appears upon the surface of the skin, and the whole process receives the name of *Insensible Perspiration*. It is the emission of vapour from the surface of the body. But when violent exercise is taken, or under some kinds of mental emotion, or when the body is exposed to a hot (and especially to a hot, moist) air, the perspiration or sweat becomes *sensible*, that is, appears in the form of scattered drops upon the surface.—HUXLEY'S *Elementary Lessons in Physiology*.

All these influences tend to cause the headaches, inattention, heaviness, and stupor so frequently met with in school children; but it is the teacher in whom these influences are mostly seen. When he has finished his day's school work, he is too tired to take that exercise in the open air which is necessary to renew his supply of good bracing oxygen, and enable him to get rid of the bad products he has inhaled during the day.

We have inspected some schools in which not more than 125 cubic feet of space was provided for each boy, and the condition of the air was such as to create a desire to make a speedy exit from the school-room.

A varying number of years of a child's life are spent in school. It is of the utmost importance that during this period he should be provided with pure air. For the proper growth and development of his body, pure air is a necessity, not a luxury. It is supplied by Nature free of cost; and we should endeavour to take advantage of Nature's privilege, by providing enough space for each pupil and ample means for the foul air to make its exit from, and pure air to come into. the school-room. We would here repeat that impure air. breathed constantly, brings about impure blood, and impure blood is harmful to every tissue and organ of the body. Bad air constantly inhaled by children may lay the foundation of a number of diseases.

One of the great advantages of village or country life, is that the air is purer than in towns. The air of towns contains an excess of carbonic acid gas and other impurities; hence the greater importance of thorough ventilation of town-houses.

At certain seasons in the plains in India, the air inside houses is really cooler than the air outside. Under these circumstances, ventilation is at a standstill, and those who can afford it have *punkahs*, *tatties*, and *thermantidotes* to keep down the temperature and help the circulation of the air. In some places, such appliances are very useful.

SUMMARY OF THE FOREGOING PAGES ON AIR AND VENTILATION.

I.—To keep in health, nothing is of greater importance than *fresh air*.

II.—Nature charges us nothing for this her most valuable gift. We should not prevent its entering our houses.

III.—When we breathe, we affect the quality of the blood for good or bad—good air purifies, but bad air poisons the blood. Foul air in our rooms is created by our own breath, by burning candles and lamps, by dirty clothes, by decaying animal and vegetable matter, and by want of general cleanliness.

IV.—We are constantly fouling the air by breathing, and by the exhalations and particles from our skin. We should be constantly supplied with fresh air into our rooms—as much fresh air as possible to enter the rooms we occupy. Our rooms should imitate our lungs, that is, they should constantly take in fresh, and let out impure, air.

V.—The best way to keep the air moving incessantly in a room is to keep the windows and doors open.

VI.—Fresh air is more important for bed-rooms than the rooms occupied during the day. In going out, we should if possible, and if not prevented from doing so for other reasons, keep the windows open during our absence.

VII.—We should not keep vegetables, food, fruit, or soiled clothes in the rooms we occupy.

VIII.—All refuse (liquid and solid) should be at once moved from the interior of the house we occupy.

IX.—It is advisable to place all dry refuse in the dust-bin at once. If there be no dust-bin, dry refuse should be burnt.

X.—We should bear in mind that the constant breathing of impure air begets a general lowering of the activity of all our vital processes, impairs nutrition, leads to a loss of muscular strength, and the blood becomes laden with bad matters, because they are not got rid of as soon as they are formed. The unfortunate person who is thus affected falls an easy victim to disease.

CHAPTER IV.

WATER.

Uses of water in the body—Diseases arising from impure water—Composition of water—Quantity of water required—Sources of water—How the water is rendered impure—Physical characters of good water—Purification of water.

AS one of the first requirements of life, water comes next to air. If deprived of air for a few minutes we could not live. Without water for some days we should die. In the latter case death is slower, but quite as certain. Without food life may be prolonged for some time, if water is obtainable.

The same holds good with regard to all animal life, and with almost all vegetable life. We say "almost," because some of the lowest forms of vegetable life, such as some disease germs, appear to possess the power of living in the absence of water. But even these germs cannot shew signs of vitality when moisture is entirely withdrawn.

We are constantly throwing off a lot of water from our body—from the *lungs* in the form of watery vapour; from the *skin*, in the form of sweat; and from the *kidneys*, as urine. To replace these losses we must be supplied with water of good quality, and in proper quantity.

Uses of Water in the Body.—Water serves many purposes in the human body: (1) It keeps the blood in a fluid state, in which form alone it could carry out its function as a nourishing medium to the organs and tissues of the body. If the blood contains less than a certain amount of water, it becomes so thick that it cannot pass through the smallest blood-vessels or capillaries. This occurs in cholera. Many of these little tubes are much finer than the fibres of a spider's web, and require a microscope* to distinguish them. (2) Water dissolves the solid parts of the food, both before and after eating, so as to enable them to pass into the blood-vessels and be in a fit state to nourish the body. (3) It serves to wash out all the bad matters from the body.

Diseases arising from Impure Water.—The necessity of using pure water will be impressed upon us, if we consider some of the diseases that arise from the use of bad or impure water. Of these diseases, the following are the chief:—Bowel complaints—cholera, dysentery, and diarrhœa; malarial fevers and the diseases connected with malaria—ague, remittent fever, enlarged spleen, anæmia or bloodlessness, and liver diseases; typhoid, enteric, or bowel fever; dyspepsia or indigestion; stone in the water-passages, goître, external and internal animal parasitic diseases, as guinea worm and round worms.

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* The *microscope* is an optical instrument, consisting of an arrangement of lenses which enables the observer to see an object, or its true image, nearer than with the naked eye, and magnified accordingly.

Cholera.—In Lower Bengal, and in some of the larger towns and cities of India, cholera is *endemic.*[*] It has occasional epidemic outbreaks in those places, but an entire cessation of the disease rarely occurs, or occurs only at certain seasons of the year. When the circumstances under which this dreadful disease takes place are present, and it has once made its appearance, it may spread to an indefinite extent. Water is one of the chief means by which cholera is spread. There are doubtless other agencies through which it may be diffused, such as impure air, foul clothes, &c., yet water, in most outbreaks, plays an important part in this respect. This is shewn from the great decrease of the disease in Calcutta and Madras since a supply of pure water to those cities has been introduced. The chief water-supply of Calcutta was formerly from open tanks and the Hooghly River. The tanks were subjected to contamination in various ways. Into the River Hooghly the night-soil of the city was allowed to flow, and dead bodies (many probably the corpses of deceased cholera patients) were thrown. The matter was inquired into and a new and improved water-supply was started, with the result that the number of cholera cases has decreased by one-half.

A few instances will shew how impure water brings about cholera. Several hundred emigrants were on board a ship in the Indian Ocean. All the people used the drinking-water that was supplied in Calcutta from the public hydrants. One of the coolies got cholera. The issue of Calcutta water was prohibited, and pure water, distilled from the sea, used instead. The distilling apparatus got out of order, and Calcutta water had to be used once more. The day this was done several fresh cases of cholera occurred. The only conclusion to be arrived at is that the water put on board had been previously fouled. On the other hand, it is difficult to see how the water in the public hydrants could be fouled. But how is the water rendered impure in such a way as to give rise to cholera? It is generally believed that the poison of cholera exists in the excreta* of patients suffering from the disease, and that water becomes in some way or other affected by these excreta. In many outbreaks, the soiling of the water by the excrement of cholera patients has been proved. A notable instance occurred in London in 1854. A little girl was attacked with cholera in the streets. Her evacuations were passed near a pump, the material finding its way to the water in the pipes below. In 24 hours, 145 persons suffered from the disease, and all those who suffered obtained their water from this pump. Further, at this time, a woman living some miles away, got the disease, and it was proved that this person, preferring the water from the particular pump in question to that of any other, used to have a bottleful of it sent to her daily.

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[*] *Endemic diseases* are those that are peculiar to special localities.

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* *Excreta* are the waste materials thrown off by the excretory organs—bowels, kidneys, skin, and lungs. In this particular instance it applies to matters either vomited or passed by the bowels.

A direct proof of the contagiousness of the excreta of cholera patients is given in the following case. A part of the evacuation of a cholera patient was mixed, by accident, in the water contained in a *ghurrah* or earthenware chatty. The *ghurrah* was exposed to the sun for many hours. Next morning 19 persons swallowed a small quantity each of this water. Within 36 hours 5 of them were seized with cholera. Another recorded instance is given, where the supposed germ of cholera was found in the water of a tank. A woman who drank of this water was attacked with the disease. Cholera sometimes attacks large numbers of people at one time, and spreads rapidly over the country. Its spread is nearly always along the line of rail, or along roads travelled by human beings. We can explain how this spreading occurs. Say, a wayfarer imbibes the poison of the disease in Calcutta, but does not shew signs of it till he has entered the train. His discharges are deposited within the compartment he occupies. It soon dries up into a fine powder and spoils the air. This air is breathed by other passengers, or the dried up particles get to the back of the throat and are eventually swallowed. Further, suppose the first man so attacked recovers. He takes his soiled clothes to some well and washes them at its margin ; some of the slops find their way into the well, and render all those who use the water liable to cholera. He likewise carries out his personal ablutions at this well. This may appear to be a far-fetched explanation, but we can vouch for its reality.

Last year, whilst seeking the cause of an outbreak of cholera in Bagum Bazar, in Hyderabad, we entered several huts where patients were suffering from the disease. In one hut laid a helpless man in a low state from cholera. He had passed his stools over the ground, and had vomited in several places, soiling the cooking utensils and his *lotah*.* On making inquiries it was ascertained that his wife had just drunk water out of the *lotah* so soiled. The man recovered, but the unfortunate woman died of cholera. Later on, we shall see how all wells, tanks, and water-courses are being constantly polluted, and how easy it is for the cholera poison to affect us, and yet, how readily all this might be avoided by the exercise of a little common sense and cleanliness.

In the year 1879, five millions of people died in India—3 millions from fever and 265,000 from cholera.

Diarrhœa.—Impure water plays an important part in producing diarrhœa. This is especially the case if the impurity arises from decomposing animal and vegetable matter. Such decaying animal matter is most frequently derived from human ordure, which in some way or other gains access to and mixes with drinking-water. Sometimes, however, dissolved and undissolved mineral matters contained in water create relaxation of the bowels.

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* The brass utensil used for drinking out of.

Dysentery—This disease is also said to frequently arise from drinking impure water. It is especially caused by the water from marshes and *jheels*.

Ague.—The ordinary fever of this country is ague or intermittent fever. It most frequently arises from breathing air containing the malarial poison, but it is sometimes due to drinking water charged with decaying vegetable matter. This was known 2,000 years ago. It was then written that the " drinking of marsh water causes spleen disease," and we know that such disease in India most frequently arises from ague. Many outbreaks of ague have occurred from water containing decomposing vegetable matter. As an instance of marsh water causing ague and dysentery, the following is a case in point: A young man just arrived from England went on a shooting tour. On the first day he lost his way in the jungle; he got very tired and thirsty, and was forced to drink the unfiltered, dirty, water from a *jheel*. *That evening* he suffered from an attack of ague and dysentery. An instance is on record where a number of villages were situated on marshes: in some ague was present, in others it was not. Those in which the fever occurred, were supplied by marsh and *nullah* water. In the others, the water-supply was from good wells. In one village there were two sources of supply—(1) a tank fed by sub-soil* and marsh water; and (2) a spring. Those only who drank the tank water got fever.

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* Sub-soil water is the term applied to the water which fills in the interspaces in a porous soil.

Typhoid, Enteric, or Bowel Fever.—This disease arises chiefly from water fouled by the stools of patients suffering from it. It does not often affect the people of India, but is very fatal to young European soldiers coming to the country. It frequently arises from the use of foul water used by *gowlies* to adulterate milk.

In places where water contains much mineral matter, stone in the bladder or water passages and goitre* are frequently met with. This is especially the case in certain parts of the North-Western Provinces and Oudh.

Worms.—The human being is liable to suffer from several kinds of "worms." The eggs or embryo of many of them gain entrance to the bowels through drinking-water; others, as the guinea-worm, attack the surface of the body. Many vegetable parasites are said to come from bathing in impure water, as ringworm† and fungus foot.

The heavy mortality‡ of certain parts of India is largely due to impure water, and we believe that improvement of the water-supply throughout the country would considerably lessen the death-rate.

We have said enough to show that the use of pure water is very injurious, and often very fatal. This has been known for ages. The pollution of drinking-water was strictly forbidden in the early sacred writings of the Hindus. The Arana of the Yajurveda contains the following order: "Do not pass urine or discharge excreta in the water. Do not throw any hair, or nails, or bones, or ashes, nor dip dirty clothes into the water. For to do so is to abuse the precious gift of the gods and disgrace them." Persons suffering fron contagious skin diseases were forbidden to bathe in tanks or ponds. *Menu* says: "Let him not cast into the water either urine or ordure, nor saliva, nor cloth, nor any other thing, soiled with impurity, nor blood, nor any other kind of poison." In the days in which these laws were given to the people, the fouling of water in every way was thought a great sin.

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* An enlargement of a gland situated in the front of the neck.

† Dâa Hin.,

‡ *Mortality* is a word used to denote the death-rate of a community or country per annum. The death-rate is usually stated as so many deaths per 1000 of population. Thus, in Chudderghat, in 1888-89, it was 22·61, which means, that of every 1000 persons living 22·61 died during the year.

COMPOSITION OF WATER.—Water is a compound of two gases, *oxygen* and *hydrogen*, in the proportion of eight of the former to one of the latter. This is shown by splitting up water into its elements, which may be effected by means of the two poles of an electrical apparatus; or by bringing the two gases together in proper quantities, and passing an electric spark through them: water is then formed, the two gases joining to form it.

We have said that the continuance of all organic life demands water, and that water enters into the composition of all vegetable and animal bodies. Although the human body appears to be a solid mass, yet, about three-fourths of it consists of water.

Everything we eat contains more or less water. A pound of mutton contains 12 ounces of water. The same with regard to potatoes. A pound of *chappaties* contains about 6 ounces of water. All the beverages we drink, consist almost entirely of water, and green vegetables contain about nine-tenths of their weight of it. Water, then, is a very important item in our existence.

General Uses of Water.—Water is used for drinking; for cooking food; for preparing tea, coffee, and various other beverages; for washing our clothes: for cleaning our cooking utensils, plates and dishes; for personal cleanliness; for washing our houses and furniture; for keeping down the dust on roads, and for the cleansing and flushing of drains or sewers. It is required for the domestic animals we keep and for carrying on various trades. Water also serves to keep our ground clean, washing away the impurities, and without it plants could not be nourished, grow, and yield us food.

QUANTITY OF WATER REQUIRED.—The average quantity of water required for each person will vary according to the extent to which the processes enumerated in the preceding paragraph are carried on. If the sewage of a town is removed by underground pipes, a large quantity of water per unit of the population will be required to keep the sewers well flushed and clean. The *quantity of water required for different purposes* will also vary in different places. and amongst different classes of people.

The quantity of water required for *drinking* purposes will vary according to age, sex, weight, and race of the individual, and according to the climate. As a general rule, it may be said that *half an ounce is required for each pound weight of the body.*[*] In less general terms we may state that a man requires from 75 to 80 ounces of water a day. Of this quantity about one-third is contained in the so-called solid food. To prepare this solid food and fit it for consumption and assimilation[†] water is added, so that, on the whole, only about one-half of the water is left to be taken in the liquid form. Owing to the free action of the skin (sweating) in India, a larger quantity than that given is required. A man weighing 120 lbs. would require from 80 to 90 ounces, that is, about half a gallon. Of the water taken in the food and as drink, about 50 ounces is got rid of by the kidneys. about 18 ounces by the skin, as perspiration, and the remainder by the lungs. In the hot weather, however, a great deal more is given off by the skin and less by the kidneys. During hard physical labour, we perspire a great deal more and give off more watery vapour from the lungs than at other times. The kidneys, on the other hand, secrete less water under these circumstances. If the air is dry, an increased amount of water is given off by the skin and lungs. In these last two cases (increased exercise and dryness of the air), it is through the heat lost by evaporation that our bodies are kept from becoming too warm, and are kept at normal temperature.*

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[*] Most of our solid and even our "dry" food contains moisture. Thus, potatoes contain about 75 per cent. of water, bread about 50.

[†] *Assimilation* is that process in the animal economy by which the ingredients of the food are converted into blood, and by which the blood is transformed into parts of the various organs and tissues of the body.

For *drinking* purposes, half a gallon is the least quantity that can be supplied to an adult.

For the *cooking* of food, an adult will require three-quarters of a gallon. Much of this will not be used, as it is evaporated in the cooking process. In wealthy households, where the cooking arrangements are on a large scale and the meals frequent, a great deal more will be required.

For *washing utensils and dishes*, about a gallon is required per head. The quantity, however, will depend upon the number of dishes in use.

The *cleansing of houses and furniture* will require about two gallons per head.

Clothes washing will require at least three gallons per head.

For *personal cleanliness* the quantity used will depend on the habits of the person. To wash the hands and face twice daily, and to take a daily douche-bath, will require about five gallons.

In towns where proper water-closets are not in use, about one gallon daily for each person is required to keep the privy pans and the privies clean. This altogether makes 13 gallons a day for each person.

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* The natural temperature of the human body is, on an average, throughout the 24 hours, 98·4° Farh.

To tabulate the water required for these purposes we require for—

	Gallons.
Drinking and cooking	1
Washing dishes and utensils	1
House cleaning	2
Clothes washing	3
Personal cleanliness including douche-bath	5
Cleaning privy-pans and privies	1
Total.	13

The washing of clothes and the daily bath are frequently gone through at *ghats* or wells. In any case, we consider that *the least quantity necessary for each person is six gallons.* There are very few houses in which even this small quantity of water is used. In several instances lately inquired into, we found that the average quantity used in the houses of the poor was *less than two gallons* per head. In one hut, six people dwelt—three adults and three children. The entire quantity of water used during the day was four brass *ghurrahfuls.* The brass utensil contained about two gallons. *Each person got, therefore, only a gallon and a half a day to use for all purposes.* No wonder they were living in the condition of squalor in which they were found. In favour of the poor, it is to be said that much difficulty is found in drawing water from wells, which are at times far from their huts. Yet there is, in a large number of cases, an utter indifference to dirt in all its forms. We do not make this statement against the higher caste people, for they are, as a rule, exemplary as to the cleanliness of their bodies and of the *interior* of their houses. But even amongst these, the outside of the house is neglected, and all manner of filth is found strewn about their compounds.

Domestic animals require a large quantity of water. An ordinary horse requires at least six gallons to drink and two for washing. About the same quantity will be required to wash a cart, if in use. A cow drinks five gallons ; a sheep and goat about three-quarters of a gallon each.

Public Water-supply through Pipes and Hydrants.—Some towns in India are supplied with water by means of properly-constructed water-works. The source of the water is primarily from rivers or large tanks, whence it is conveyed in cast-iron pipes to large reservoirs, in which the water is filtered through layers of sand and gravel. From these reservoirs it is distributed to the different parts of the town, by means of other pipes, which go along the main roads, streets, and lanes. At certain distances, taps or hydrants are attached to the pipes. From these taps or hydrants the people supply themselves with as much water as they need. The water should be allowed to run all day in the pipes. Usually there is enough water to give each member of the community so supplied 20 gallons. Such water-works now exist in Calcutta, Madras, Bombay, and other towns in India. Recently, similar water-works were opened in the Residency Bazars of Hyderabad and in the suburb of Chudderghat, and it is hoped ere long that hydrants and taps will likewise be seen in the streets of the City of Hyderabad itself.

It ought to be a recognised principle of sanitation, that wherever a permanent supply of good water is available, it should be provided for the people. No labour or expense should be spared to get water from a pure source. It is only by so doing that we can entirely remove from the lower classes the power to pollute the water. Locked up in water pipes, they cannot get at it. It is thus that we shall help to lessen, if we cannot stamp out, the ravages of cholera and other diseases. We must remember that a deficiency of pure water in a community brings about accumulation of filth in all its forms, with all its evils.

SOURCES OF WATER.—The primary sources of all fresh water are the seas and oceans. From them the heat of the sun causes the water to evaporate into the air, in the same way that the water disappears from a tumbler, if exposed to the sun's rays. The oceans are very large, and a considerable quantity of water is drawn up from them in the form of vapour, to mix with the air. When the wind blows towards the land, this hot and moist air from over the ocean is driven to a cooler place. Now, when the air gets cold, it cannot hold this water any longer in the form of vapour, clouds form, the little particles of water in the clouds join together and descend. The water which thus drops we call *rain*. The air always contains some of this watery vapour or steam. We see this when, in the hot weather, we put ice into a glass of water. The outside of the glass at first acquires a hazy appearance, and then we see droplets of clear water on it. The cold glass has cooled down the air surrounding it, and caused the moisture in the air to condense into drops. When it rains hard, the greater part of this rain-water finds its way to the large rivers, and, finally, into the seas and oceans whence it originally came.

Snow and Ice.—In some countries, during the winter, the air is so cold that the particles of vapour are converted into a solid modification of water called *snow* before they touch the ground. This is the case also in some of the Himalayan mountains, where the tops of the mountains are always covered with snow. If this snow does not melt at once, it forms sheets of ice. In the intervals between the rainy seasons, large rivers, such as the Ganges and Jumna, are chiefly supplied by water from the melting of this snow and ice. We have mentioned the oceans as supplying the vapour to form rain. But this vapour also rises from all exposed sheets of water,—rivers, tanks, wells, marshes, pools, and lakes. We are familiar with the fact that in the hot weather many tanks and small rivers dry up.

When rain reaches the earth, some of it flows at once into rivers, some of it sinks into the ground, and some of it goes into wells and tanks. That part of the rain which sinks into the earth feeds the wells, tanks, and rivers, when the rains have ceased.

Water, then, comes from the ocean and goes back to the ocean. This is why there is no lessening of vater in the entire globe. There is a change of orm constantly going on, but no decrease in amount.

We get our water from rain, rivers, springs, tanks, vells, and public water-works. Many dirty people get it from ditches and pools.

Rain-water.—Before rain-water touches the ground, it is pure and fit to drink; it is really istilled water. In some places out of India, people re obliged to collect the rain-water from the roofs f houses and store it in tanks, which are usually nder-ground. In collecting rain-water in this way, t is often made impure from bird droppings, *chunam*, nd decaying vegetable matter mixing with it. If rovision is made to prevent such fouling, and the vater is kept in properly made closed cisterns, it nay be kept pure and wholesome. As soon as rain-vater touches the earth, it dissolves out a lot of the oluble* salts contained in the soil, as well as decayng organic matter. In all populated places the soil ontains a large amount of decaying vegetable and nimal matter. Rain-water coming into contact vith this is made very impure. Further, the rain, n passing through the lowest layer of air, washes ut the bad products of the air and carries them vith it.

River-water.—This is usually impure and unvholesome. Every river in India is more or less olluted. They all contain earthy matter. In the

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[*] *Soluble* means susceptible of being dissolved in a fluid, nd here refers to certain of the mineral constituents of the oil.

largest rivers and those that flow rapidly, the water may be fit to use after filtration. They would all contain drinkable water were they to be kept in their natural state. When people begin to build a village or town, they usually do so on the banks of a river; and we know that whenever people gather together in large numbers, they pollute the water-supply if it be from wells, tanks, or rivers. If many such towns or villages are on the banks of a river, the water flowing by the lowest towns will be altogether poisonous. The water of rivers in the vicinity of all large towns and cities is grossly contaminated by decaying animal and vegetable substances.

During the monsoons the rivers look muddy. They then flow with greater rapidity and stir up the dirt from the bottom. At this time, also, the rain-water carries into the rivers lots of earth and organic matters. A muddy appearance does not disqualify water for drinking purposes. If you let muddy water stand in a vessel for a time, you will see that the mud goes to the bottom because it is heavier than the water. We can hurry this deposit to the bottom by adding a little alum, or by using the clearing nut.*

Spring-water—Is usually very pure, though it is occasionally hard. It is clear and sparkling from the dissolved carbonic acid gas it contains.

Jheel or Marsh-water.—Water from this source is always very impure. It is one of the most unwholesome kinds of water that can be used. It contains nuch decaying vegetable matter. This decaying egetable matter is the chief cause of malarial diseases, —ague and other fevers, dysentery, diarrhœa, enarged spleen, &c. We should never drink such vater. If compelled to do so, we should first give it series of boilings and then strain or filter it.

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* The clearing nut is the fruit of the *Strychnos potatorum*

Well-water.—There are three varieties of wells—hallow, deep, and Artesian. The water they yield aries greatly. A *shallow well* is one that is of slight epth, or sunk only to the depth of 20 to 40 feet, r if deeper than this, it does not extend below the urface of the first impermeable layer of the earth's rust.* It is, therefore, exposed to pollution from the oul bodies at or near the surface of the soil. Water rom such wells is always of suspicious quality, and unfit for drinking without previous preparation. deep well is one that is sunk to the depth of 40 or 0 feet or more, or one that passes through the first npermeable layer of the soil, which is generally stiff lay or rock. Water from such wells is, as a rule, ery pure, and free from fouling by organic matter.

Artesian wells are made by boring into the ground ntil a layer of water is come upon, which layer has n some other place a higher level. The water is rced up and spouts out as an artificial spring. Vater from such springs is generally very good and vholesome, but lies so deep that it is too costly to bore for it. Such wells have not as yet served any practical purpose in Indian town or village hygiene.

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* *Impermeable* means not permitting passage, and here efers to not permitting the passage of water through this yer of the earth's crust.

Quality of Well-waters.—We see, then, that the water of wells may be good or bad. If a well is deep that is, when the water is about 50 feet from the surface, the water is probably good, if the surface drainage does not flow into it. The water of a shallow well is always more or less impure.

Under the surface of the ground there is everywhere a large bed of pure water—a kind of subterranean lake. This water is usually very deeply situated.

Nearer the surface there is another layer of water called *sub-soil water.* This water is not good, because it takes up the bad matter from the surface and carries it into the soil. Further, it dissolves out the bad matters that the soil contains.

Tank-water.—A large part of the people of India use tank-water for drinking and cooking purposes. When originally filled, the water in all tanks is more or less impure, but the people, by their bad habits, render it still more unwholesome. The water of tanks that are drying up rapidly is usually very impure.

Water of Ditches and Pools.—The water of all ditches and pools is very impure and very dangerous to use, especially when the ditches and pools are near houses.

How the Water is rendered Impure.—Although very strict laws are laid down in the sacred books of the Hindus against pollution of water, we find that these laws are never obeyed. The lower class of people are constantly and systematically polluting all sources of water-supply. Let us go to the banks of any river situated near a town or village and keep our eyes open: we there see people using the banks of the river as a latrine, and subsequently rising and washing themselves in the water. We see people washing clothes in the river. Soiled clothes contain the waste matters from the body. Sometimes these clothes have just been worn by people suffering from infectious or contagious diseases, such as small-pox, cholera, &c. It is clear that if the germs of disease are washed into the water, those living lower down and using the water are liable to be attacked. The bodies of people who have died of cholera or small-pox are often thrown into rivers. Further, human beings may be seen bathing and spitting in the river, and drinking the water afterwards. Cattle, horses, and elephants are taken to the river to be washed; their droppings and urine pollute the water, so do the foul matters washed off the surface of their bodies. In small rivers and streams these practices are very injurious to health, and may serve to cause serious outbreaks of sickness.

We have said that the water of large rivers is, as a rule, purer than that of small ones. This is because the poisons they contain are more diluted. Large ivers also flow quicker, and in doing so mix with more air, the oxygen of the air acting as a purifying agent on the organic matter in the water. The water f rivers may be maintained in a state of purity if people will cease to defile it in the various ways we have mentioned. The refuse liquids from houses and drains should not be allowed to flow into rivers.

The same *sources of pollution* are in constant actio in *tanks.* If no other water-supply than that from tanks is to be had, special tanks should be set apar for bathing, and others for drinking purposes. All drinking-water tanks should be properly protected. The access of grazing animals to the tanks should be rendered impossible. This could be easily done by surrounding the exposed sides by a proper railing, or by constructing steps al round, by means of which to approach the water. No person should be allowed to draw water in dirty utensils, and all vessels should be thoroughly cleaned before dipping them into the water. This cleaning should not be carried out in the tank itself. People should not wash their feet, hands, or mouth in the tank, and the disgusting habit of spitting in the water should be strictly forbidden. No trees should be allowed to grow near tanks, for the dead leaves are blown into, and decay in, the water. Fishes and certain water-plants help to purify the water. The fishes feed on the organic matter and insects in the water, and the plants give out oxygen which helps also to purify the organic matter. All the ground around the tank should be kept clean. The *surface drainage* should be prevented from flowing into the water. If it is necessary to provide for watering horses and cattle near the tank, a special cistern or trough should be constructed for that purpose. It should be remembered that cattle and horses are to be supplied with pure water, as well as ourselves, for many of the diseases of these animals are due to bad water.

Pollution of Wells.—The in-flow of surface drainage water is the chief source of pollution of wells. By *surface drainage* water is meant all refuse water of the soil from human habitations and elsewhere, before it finds its way to a proper water-course or channel. It is the rain, house-refuse liquids, &c., that reach the surface of the ground and pass along the natural line of drainage without penetrating the soil. This surface water in passing over filthy ground carries with it many forms of poison. The flow of surface water into wells may be readily prevented by constructing a proper parapet wall round the mouth of the well. The *sub-soil water* should not feed wells, as before entering the well the water has dissolved out the impurities of the soil. Our deep wells should be protected by being lined to a depth of 15 feet. at least, with a good layer of hydraulic or water-tight cement. And even the shallow wells would be improved by such steining.* If the surface water then does sink below this lining, it is at least filtered through 15 feet of soil before entering the well. From the outer-side of the base of the parapet wall, there should be a smooth sloping pavement, extending for five feet or so all around the well, and this should be surrounded by a drain, which would convey all refuse waste water, either directly into the public drain or into a cistern. In the latter case, the foul water should be periodically removed. The bottoms of all wells require to be cleaned out once every two years at least. Unless we see the matter that is removed from the bottoms of some shallow wells, and smell it, we could not imagine that such filth could be contained in them. Yet we are daily drinking part of this disgusting material in a dilute form, because we do not get our water from a source which cannot be contaminated by filthy habits and by surface drainage.

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* *Steining* is the technical term used by engineers for such lining of wells, &c.

No dirty utensils should be used to draw water from wells. It would be a great improvement were the people to draw well water by means of a metal bucket, which should be kept constantly at the well. Caste prejudice comes in here, but this might be overcome by using separate buckets for different castes. No trees should overhang wells, or their roots be allowed to grow into them through the walls and break the lining; leaves fall in and decay in the water. Another important improvement would be effected by cementing the mouths of wells with wooden covers. These, in addition to keeping out birds, bird-droppings, insects, falling leaves, &c., would remove the possibility of the people fouling the water by their habits.

That a well is popular as a source of drinking water, does not ensure its purity. The water of wells containing organic matter that is undergoing decomposition frequently has a peculiar but not altogether unpleasant taste: further, such a water has a slightly sparkling appearance, due to the carbonic acid gas that is set free by the decaying organic matter. These are the properties that frequently induce people to seek out a particular well.

As water is so important an item in our bodies, it should be pure. To the people of India, more than to any other race, it is necessary that the water they use be wholesome, for they are the greatest water drinkers in the world. Other nations, as a rule, modify the action of the impurities of water, and render them less injurious by the addition of other bodies to the water. But the Mahomedan and Brahmin prefer water in its simple form. When speaking of climate, Mahomedans refer to the condition of the air and the water, *ab-o-hawa*, and we may state in general terms that if both the air and the water of a locality are pure, the climate will be good.

We have said that a number of towns in India enjoy the benefits of public water-works. The water in some of these cases is brought from a long distance in cast-iron pipes. This is a great blessing to the people. It takes from them the power of polluting the water by their unclean habits. We hope, at a time not far off, to hear of such public water-works being opened in all towns, cities, and municipalities in India; but until this happy time arrives, we must take every precaution to get our water as pure as possible and to keep it pure. We have examined the water of many of the wells in and around Hyderabad; in nearly every case it was bad—in some cases it was so unwholesome that we were compelled to close the wells permanently.

PHYSICAL CHARACTERS OF GOOD WATER.—Good water is clear and free from any sediment or suspended matter. It should be colourless or have only a faint bluish tint when viewed through a depth of two or three feet. *Greenish* waters may not be bad, but *yellowish or brownish waters* are impure as a rule. Water should be bright and sparkling. This shews that it contains the necessary gases to make it palatable—oxygen and carbonic acid. The taste should be pleasant. There should be no smell, and it should dissolve soap readily. A water that possesses these characters is probably drinkable. But it may not be so, for the most dangerous agents in water are disease-germs, and these are invisible, and may exist in vast multitudes without being known to our senses.

Hard and Soft Waters.—We have said that as soon as rain water reaches the earth, it dissolves out salts of different kinds, and frequently organic matters. Different soils contain different salts, and in accordance with the nature of the soil will be the quality of the water. If we boiled down a pint of *distilled water* we would find that in time it would all disappear—there would be nothing left. Doing the same with any spring or ordinary water in a clean white vessel, we would find a solid residue left. Why is this ? It is because the rain water in falling to the ground, and passing over and through the soil, always finds saline bodies that it can dissolve and take away with it. The sea is, in this way, constantly having these salts added to it, and is becoming very gradually more saline. We may now understand what is meant by *hard* water and *soft* water.

A *hard* water is one with which soap does not at once form a lather, but with which it produces a curd or deposit. The chief cause of this is the existence of lime and magnesium salts and acids in the water. The only acid naturally contained in water is carbonic acid gas; but this helps to keep the lime and magnesia dissolved in the water. By *boiling* we drive off the carbonic acid, and the lime falls to the bottom. This is well seen when much chalk is contained in the water. A hard water gives a rough feeling.

A *soft* water is one that forms a lather at once, when soap is rubbed up with it.

Hard water is bad for many reasons. It does not wash clothes properly, and in washing clothes with it much soap is wasted. It is bad for cooking with, and especially for boiling vegetables in. You cannot infuse tea in it perfectly.

The hardness of water is calculated by the number of grains of chalk in each gallon of water. About 14 grains to a gallon is the limit allowable.

The following *classification of waters** shews roughly the relative degree of wholesomeness and palatability of water from different sources:—

Wholesome	1. Spring water	Very palatable.
	2. Deep well water	

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* Sixth Report of the Rivers Pollution Commissioners of London.

Wholesome.	3. Upland surface water	Moderately palatable.
Suspicious	4. Stored rain water	
	5. Surface water from cultivated land	Palatable.
Dangerous	6. River water to which sewage gains access	
	7. Shallow well water	

PURIFICATION OF WATER.—There are very few waters that do not require some form of purification before being used for drinking purposes. Rain-water (if collected pure), distilled water, and water from mountain streams, may be used without any preparation; so may the water supplied by water-works, for in this case water has been tolerably well fitted for all purposes by previous filtration through sand and gravel before distribution. In all other instances the water should be thoroughly filtered, or better, boiled and filtered. There are many towns in which it is actually dangerous to drink shallow well water without previously boiling and filtering it. The process of boiling is almost certain death to all disease germs, especially if the water is boiled two or three times. *Filtration* is readily carried out. A simple form of filter is made by suspending three earthen-ware *ghurrahs*, one above the other, in a triangular wooden frame. The top *ghurrah* is kept half full of clean charcoal: the middle one half full of sand; into the lowest one the filtered water drops and is collected. A small hole should be made in the two upper chatties, and all three should be kept covered with perforated earthen-ware plates. These plates prevent birds getting at the water or insects dropping into it. This arrangement keeps the water cool and pleasant, and allows plenty of air to mix with the water, thus removing the disagreeable flavour given by boiling the water. The water may be still further cooled by keeping the lowest *ghurrah* covered with a clean, damp cloth. Every two months the charcoal should be washed, brushed, and dried in the sun, or new charcoal used instead of old. The upper surface of the sand should be removed every six weeks, and every three months all of it should be changed. There are many points in favour of this form of filter,—it is simple, inexpensive, and reliable, and the filtering materials can be easily got at, cleaned, or removed.

There are various forms of filters sold in the market, the simplest of which are the block carbon filters and the silicon carbon filters; but of all filters, the most lasting and reliable is the *spongy-iron*[*] filter invented by Bischoff. The great point with this filter is that it splits up a part of the water into oxygen and hydrogen, and the oxygen then attacks and renders harmless any organic matters contained in the water. No matter what form of filter we use, every part of it should be accessible for cleaning. When travelling in the jungles, it is always advisable to provide ourselves with a "pocket-filter" of some description, for sometimes we have unfortunately to drink *jheel* water under such circumstances.

The addition of alum to muddy water throws down particles of mineral matter, which in their descent carry any suspended organic matter contained in the water. Water containing organic matter may also be somewhat purified, by adding a small quantity of Condy's Fluid* to it. The salt of which this fluid is made contains an excess of oxygen, and this oxygen combines with the organic matter present to render it harmless. Any water that has to be drunk, having a foul odour, is improved by adding Condy's Fluid to it. A teaspoonful is enough for four gallons. In certain parts of India, the clearing nut† is used to purify water. "It is beaten into a paste, and rubbed on the inside of the water jar or cask." The astringent matter in tea also helps to purify impure water.

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[*] *Spongy-iron* is a granular substance, very porous, and resembles animal charcoal in appearance. It is obtained from iron ore by calcination.

How to Keep Water Cool without Ice.—In some warm places, where people cannot get ice, they cool the drinking-water by the following plan:—They place several bottles of water, covered with straw, in a coverless box or in a basket. They sprinkle water over the straw to keep it constantly damp, and then suspend and swing the box or basket to and fro. The dry, heated air, coming into contact with the bottles, causes the sprinkled water to evaporate. In forming vapour the heat of the water contained in the bottles is abstracted or got rid of.

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* *Condy's Fluid* is a preparation of permanganate of potash, frequently used for purifying water containing organic matter. It does this by virtue of the large amount of oxygen in its composition, and which it gives up to oxidize the organic matter. Condy's Fluid is also used as a disinfectant and deodoriser.

† It causes a precipitation of most of the suspended impurities of the water.

CHAPTER V.

FOOD.

Need of Food—Hunger and Thirst—Life history of Amœba—Man's body-weight remains more or less constant—Human body compared with an engine—Scheme of the Circulation—Classification of Foods, Inorganic and Organic—Nitrogenous, Proteid, or Albuminous Food—Starches or Carbo-hydrates—Fats or Hydro-Carbons—Accessory Foods—Description of Nitrogenous Food—Milk—Milk as a Food for Infants—Vegetable Nitrogenous Food — Starchy Foods — Fruit—Vegetables—Adulteration of Food—Brief sketch of the Anatomy and Physiology of the Digestive Organs—Digestive Juices—Salivary Glands—Gastric Juice—Teeth—Pan Chewing—Man is both a Vegetable and Flesh Eater—Effects of Eating rapidly—Quantity of Food—Meals—Alcoholic Beverages—Habitual use of Opium—Indian Hemp or Cannabis Indica—Habitual use of Tobacco.

A FOOD in a wide sense is anything that aids in keeping up the form and action of our bodies nder all conditions of life. "Everything which goes irectly or indirectly to the growth or repair of the ody, or to create force, motion, or energy in any orm, may be called a food." Defined in this way, oods include all solids and liquids consumed and he oxygen of the air we breathe. We are already cquainted with the manner in which this oxygen s taken up by the blood, and we know that water hiefly serves a mechanical purpose in the body. We will, therefore, consider the subject of food in a imited sense.

The chief part of the food of man is obtained from the Animal and Vegetable Kingdoms. We cannot construct the complex organic compounds necessary for our diet out of the simple elements. When these compounds gain entrance into the system, they form others, which make them fit for the purposes of our body. But we cannot form them from the mineral or inorganic kingdom. There are no arrangements in the lungs for utilising the nitrogen of the air to supply us with this element, as there is with regard to oxygen. Nor can we digest, absorb, or utilize a solid piece of charcoal to provide the quantity of carbon needed. These agents must be presented to us combined with other bodies. To plants alone is given the power of forming compound organic bodies out of the inorganic kingdom. Nearly all our food, therefore, must come directly from the vegetable world, or indirectly from it through other animals.

Need of Food.—Man, as well as all things living, is always doing something—always at work. One great difference between a living and a dead object is that the former is capable of moving of itself. Now, for every little bit of work gone through by us, some part of our body is wasted. Much of the work we do is visible—such as standing, walking, running, lifting weights, throwing balls, &c. These exertions waste us and make us smaller. They are spoken of as *external work*. But there are many actions that go on without our noticing them at all, such as breathing, the beating of the heart, and the action of the brain in studying and thinking. The heart and lungs continue to work even when we are asleep. These unnoticed actions waste us too, and the exertion we go through in this way is called *internal work.*

If we weigh ourselves in a scale in the morning on rising, and repeat the weighing at noon, we will find (if we have not eaten too much breakfast) that we are lighter. That this is true has been proved by the following experiment. A healthy man was placed in a small room, the walls of which were made of ice. To prevent the ice melting, a current of ice-cold air was kept passing through it whilst the experiment lasted. The man walked up and down the chamber for an hour. In going through this exercise he used as much force as was necessary to lift the weight of his body a certain height. At the end of the hour it was found that some of the ice *had* melted, or was converted into water, which shewed that the man gave off some heat. Further, the air, when tested with lime water, shewed that a large amount of carbonic acid gas was contained in it. The air which he inspired was almost dry, but the expired air contained in the chamber was saturated with moisture. The man was weighed in a very accurate scale, called a *balance*, before entering the room, and again at the end of the hour. He was found to be lighter. We see, then, that an active man is constantly using up the store of force and food in his body. He is giving off heat, throwing off carbonic acid and water, and is losing substance. This could not go on for any time without his visibly diminishing in bulk.

Hunger and Thirst.—Long before the effects o loss of substance are seen by any one else, the healthy being feels them. *Hunger* and *thirst* are the tw sensations that let us know we require to renew the store of force and food in our bodies. To quiet these cravings and make up the loss of body-weight, we convey food and drink into our stomach.

Before considering the method by means of whic the food is made suitable to pass into the bloo vessels, let us inquire as to what goes on in the lowest form of animal life.

Life History of Amœba.—In almost every tank and pond we can find little particles of jelly-like animal matter. Each particle is a separate animal They have no lungs, heart, brain, spinal cord, o stomach, yet they digest their food, breathe, move, an even multiply without mating. This little animal i called an *amœba*, and consists entirely of protoplasm in its simplest form. In moving it throws out a littl bit of its body, the rest follows. When it comes int contact with anything it can use as food, it flow round, and then embeds the foods in its body. I digests what it wants, and flows away from the par it does not require. It breathes by taking up th oxygen of the air dissolved in the water, and throw off carbonic acid gas. It multiplies by throwing ou little buds, which become detached from the mai body. The detached bud commences life on its ow account, and—like the parent—lives, moves, throw out other buds, and dies. The bodies of all the highe animals, including man, also consist of a multitud of these little protoplasmic particles, with this difference, that in the higher animals, these little bodies have become altered to form organs and tissues. Each organ and tissue so formed carries out a special office in the body. This is what is meant by "division of labour and differentiation of structure in the animal economy." Our blood contains little particles of protoplasm called *white blood cells.* The blood also contains another variety of cells called *red blood cells,* which are formed chiefly from the white. We have mentioned that oxygen is taken up by the blood from the air in the lungs. This is effected by the red cells of the blood,—they are the carriers of oxygen to the tissues and organs.

MAN'S BODY-WEIGHT REMAINS MORE OR LESS CONSTANT.—An adult man wastes about 6 or 7 lbs. in the day. We find that he gets no thinner—he remains almost the same weight. But if a boy weighs himself once a month, he will find that his weight is increasing. A man does not lose or gain weight, because what he eats and drinks is just enough to make up for the waste. A child, on the other hand, uses more food than balances the waste, and so increases in weight. If we neither eat not drink we should continue to waste, and in eight or ten days should die.

HUMAN BODY COMPARED WITH AN ENGINE.—The body is in some respects like a railway engine. To cause the train to move along, the engine requires fuel to convert the water into steam. If there is no fuel the engine stops. The food of the engine is fuel.

If we had no food we should "stop" also, that is, we should die. The strength we have comes from the material we consume. *Food, by undergoing a slow form of burning, keeps us warm.* One of the signs of starvation is coldness of the body. *The food in burning creates force that enables us to move about.* The food also serves to repair the tissues. The food we eat is not much like the different parts of the body, but it becomes altered so as to be converted into the tissues. How is this? It is because we are endowed with the power of changing the food in such a way, that it can be taken up by the blood vessels and carried to every part of the body. The best part of the food is changed into blood. From the place where it is so changed, it passes into small tubes called *veins.* This *venous blood* is not quite pure and has a dark red colour. To make it pure, the veins convey it to the lungs through the heart. In the lungs this dark blood takes up oxygen from the air, and the bad products of the tissues are at the same time got rid of, as we learnt in the chapters on AIR. The blood is now of a bright red hue, and is fit for nourishing all the tissues. The blood, then, is the medium through which nourishment is conveyed to all parts of the body, and it serves, at the same time, to wash out all the waste matters from the tissues and organs. We may say that it performs a similar office to the soap and water used to wash our hands and face—it washes the interior of our bodies and carries away the bad matters.

The blood is the most important agent in the body;

t is present in, or near, all tissues and organs, for, were it not so, the parts not supplied with it would die.

SCHEME OF THE CIRCULATION.—The plan of the circulation may be seen by a little experiment. Take a rubber ball with two tubes situated opposite each other. Place one of the tubes in water, squeeze and relax the ball about seventy times in a minute; the fluid passes into the tube placed in the water and is squeezed out of the other tube by the contracting elastic ball. Imagine the outer ends of the tubes, now full of water, to be attached to each other. The same fluid then would circulate within the ball and tubes. The tube in the water represents the *veins*, the ball, the *heart*, and the other tube the *arteries*. The heart is situated within the cavity of the chest. It is a hollow vessel that is constantly contracting and relaxing. In relaxing the blood enters it by one series of blood vessels called veins, and in contracting it drives the blood out by one large vessel* which divides and subdivides to pass to every division of the body. The tubes into which it divides are called arteries. These small divisions break up and form smaller tubes called *capillaries*, which are situated between the arteries and veins, and serve, in addition to other things, to unite them. These capillaries are so numerous that they form a thick network, and are so close together that a needle's point cannot be inserted between them. We can readily prove this by pricking any part of the body with a needle ; wherever we insert it, blood will ooze out. These tubes are finer than the finest fibres of a spider's web. Before the food can reach these very fine vessels it must be changed very much. To understand how this change is brought about, we must know something regarding the nature of foods, and the apparatus by means of which this change is effected.

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* This vessel is called the *aorta*. It is the largest artery in the body, and springs from the base of the heart.

CLASSIFICATION OF FOODS.—*Foods are of various kinds.*—To enable us to have some idea as to the essential qualities of foods, it will be necessary for us to classify them in a simple way, and to briefly describe the chief articles of diet contained in each class.

Everything we eat or drink belongs to one or other of the following divisions :—

(1.) Inorganic : { Water.
Mineral matter, as common salt, &c.

(2.) Organic : { Albuminous or nitrogenous substances found in both Animal and Vegetable Kingdoms. Starches and sugars or carbo-hydrates, fats, oils, or hydrocarbons, found in both Animal and Vegetable Kingdoms.

To the *Organic* division we shall add another class, known as *Accessory Foods ;* but it should be remembered that these accessory foods are not absolutely necessary for maintaining the body in health ; they are *luxuries.*

Water.—We have already made ourselves acquainted with the most important facts in connection with the subject of water. We need here only say a few words regarding its function as a food and solvent. Our tissues and organs contain much water, part of which is free and uncombined, the other part is in close union with them. One part soaks and imbues the tissues, the other forms part of its structure. An adult man when in moderate labour requires about 46 ounces of so-called dry food to keep him in health. About one-half of this consists of water, so that only about 23 ounces is solid, dry food. An average adult loses from the skin, kidney, and lungs about 80 ounces of water daily. He requires, therefore, a similar quanity to make up for this loss. Some foods contain a large amount of water. Beef or mutton contains 75 per cent. of water; in other words, 1 lb. of either of these consists of 12 ounces of water and 4 ounces of dry solid meat. Vegetables contain from 85 to 98 per cent. of water. Such things as turnips are almost all water; fresh fruit is much the same in this respect.

Purposes served by Water.—Water acts as a general solvent, by means of which property it serves to convey nutriment to all parts of the body. It also serves to build up new tissues and repair old. So long as water is taken, the absence of all other food can be borne for a comparatively long time. When deprived of food and water, it is thirst we feel most and soonest. This thirst is felt in the mouth and throat, but this is merely a local sensation expressing a general want—a demand, on the part of the body for fluid. Water is equally necessary for the remova of decaying waste matters from the body.

Mineral Matter.—The only mineral matter fo which man craves is salt. This he takes as a regula article of diet. The other forms of mineral matte that he requires are taken in sufficient quantity with the other classes of foods—albuminous or nitrogenous and vegetables. Many substances, however, as rice sago, and arrowroot, contain scarcely any minera matter, whereas others, such as meat, fruit, and vegetables, abound in them. The desire for common salt arises from the fact that it is necessary to all the important fluids of the body, and especially to the blood; it also forms an important agent in the formation of the *gastric juice.* Mineral or saline matter is, therefore, required in the body, but it is required in varying quantity for the tissues and fluids.

Potassium Salts are contained in the blood and flesh; *lime salts* are necessary for the formation of bone, and both these forms of mineral matter are present in many forms of animal and in some vegetable foods. *Iron*, which is required in the formation of the red blood cells, is also in our food.

Certain diseases are supposed to arise from deficiency of lime in the salts of the blood. The bending and enlargement of the ends of bones met with in some children is said to be due to this cause.*

NITROGENOUS, PROTEID, OR ALBUMINOUS FOOD.—This is the class of foods which serves to furnish us with the nitrogen required for building up the tissues of the body. The principal foods of this class are obtained from the flesh of animals killed for food for man. But many vegetables also contain it; for instance, we have a nitrogenous body in beans, peas, and *dhall*, called *legumen*, which forms the chief source of nitrogen in all vegetable-eating races.

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* The disease in which these are met with is called *Rickets.*

We must always be supplied with proteid or nitrogenous food stuff. We could live on it alone, but it would not be wise to do so. Alone it is not sufficient to keep the body in a healthy state for any length of time. On the other hand, we could not live on any other class of food. Starch, sugars, and fats contain carbon, hydrogen, and oxygen, but no nitrogen. A number of dogs were fed on an entirely starch diet for some months. They then died from symptoms similar to those met with in death produced by starvation. This form of death is called nitrogen starvation. Some proteid must be added to the food stuff, which may be supplied from either the Animal or the Vegetable Kingdom. Some of the cereals contain a comparatively large amount of nitrogenous matter, called caseine, especially wheat flour and maize (*bajri*).

The chief functions of nitrogenous diet are to repair the waste of the body and build up the growing tissues. In some cases, they furnish material for combustion or oxidation, by means of which the temperature of the body is maintained, but for this latter purpose they are not suited.

As a rule, we consume only the flesh of animals that live on vegetables, although some races will eat anything from a snake or dog to a man.

STARCHES OR CARBO-HYDRATES.—About two-thirds of the food we consume consists of starches or carbo-hydrates; it includes the several varieties of starch, sugar, and gum met with in the Vegetable Kingdom, which contain practically no nitrogen, but are principally contained in what are called cereal grains.

Although the various cereals look very different from one another, they all possess a large proportion of starch, which consists of granules made up of layers, one covering the other, the outer layers being the harder. The external layer is called the *cellulose* envelope.* These granules, when subjected to heat by boiling, swell up, burst the outer covering, and form a gummy mass, which on cooling becomes jelly-like. This action of heat is necessary to enable the digestive juices to act on the grains of starch. Until this physical change takes place, starch, as an article of diet, is useless. The *saliva* or spittle contains a body called *ptyalin*,† which converts starch into a form of sugar, known as *grape sugar.* Starchy food should be slowly masticated ‡ n order that all parts of it may be thoroughly mixed vith the saliva.

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* *Cellulose* is the substance of which the permanent cell-membranes of plants are always composed. It is closely allied to sugar, dextrine or gum, and starch, and is changed into starch by heat, sulphuric acid, caustic potash, or sulphuric acid.

† *Ptyalin* is the active principle of the saliva. Upon it the faint sickly odour of the saliva depends.

‡ *Mastication* is the process by means of which the food is crushed between the teeth and rolled about in the mouth to mix it thoroughly with the saliva.

Starches enter largely into the composition of lour, *atta*, and *bajri*. Rice consists almost entirely of tarch.

The large class of carbo-hydrates includes *sugars*. There are different kinds of sugar: the one we daily se is *cane* sugar, yet all varieties of starch and ugar, before entering the blood, are changed to the ody we mentioned above as grape sugar. It is in his form that all starches enter the blood, for grape ugar is readily dissolved in the intestinal juices nd easily passes into the tiny blood vessels. A due roportion of ordinary sugar is a wholesome addition o our food. We ought to avoid using it in excess, for when too much is partaken of, it tends to spoil the teeth (especially in children), to cloy the appetite, and take away the inclination for our proper food. Sugar is also contained in many other articles—in fruits, as oranges, grapes, water and sugar melons, beet-root, plantains, and also in the flesh of animals.

The principal use of starches in the body is to *produce heat*. In some cases they are changed to fat, which are deposited in the tissues.

Fats or Hydrocarbons.—Hydrocarbons or fats are contained in both the Animal and Vegetable Kingdoms. We get butter and *ghee* from the milk of the cow, and solid fat or suet from slaughtered animals; from plants we get oil. This class forms a very valuable part of our diet, as it helps us to use the other foods inside the body. They are as necessary to a healthy dietary as the nitrogenous matters. The fats chiefly serve the purpose of heat-production in the body. When taken in due proportion with the other *aliments*, they help digestion and assimilation of the other classes of foods. If fatty matters are taken in excess, they are then deposited in the body. The fats taken as food are not, however, simply deposited in the body as fat, but are more or less changed.

Some people, and especially some children, dislike fats and oils very much. They should remember that, to keep in health, it is necessary to take a certain amount of them in some form or other. If one kind disagrees with them they should try another.

Fats are the least digestible of the different classes of food. If large quantities be taken for any length of time, corpulence and obesity * may be produced. Bilious people ought to avoid much fats and oils, for they cannot digest them. Fats and starches can, to a large extent, take the place of one another. We see this in some countries where the people live almost entirely on fat meat and oil, as in Greenland. Fat is better able to produce heat than starches, hence it is largely consumed in cold countries.

ACCESSORY FOODS—*Luxuries.*—There are certain foods (the use of which we hardly know) classified as *accessory foods.* They include a long list, amongst which are tea, coffee, extract of meat, condiments, and alcoholic beverages. We could probably do very well without them, yet they appear to be useful in some ways; in short, they are not indispensable—they are luxuries. Some are used by the nervous system, especially tea and coffee. We know by experience that a cup of strong coffee frequently removes muscular and mental weariness like a charm.

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* Obesity means fatness or grossness of the body generally.

Some of these accessory foods subserve the functions of *nutrition* in the body; others assist digestion.

DESCRIPTION OF NITROGENOUS FOOD.—*Animal Nitrogenous Food.*—In this category we shall learn something regarding those animal foods which contain substances rich in nitrogen, such as albumen, gelatine, fibrin, &c.; these are the *flesh* of animals, eggs, milk, and cheese.

The value of different kinds of fleshy food depends on the amount of nitrogenous and other matters they contain, and upon the ease with which they can be digested. All flesh contains a large proportion of water, and a varying quantity of fat—even lean meat contains fat mixed up with the flesh.

Fish.—The flesh of fish contains *albumen*, *fibrin*, and *gelatine*, as the muscular tissue of other animals does. It is less nutritive than the flesh of land animals.* There is a great variety of fish, and this variety gives every shade of digestibility. There is a certain amount of mineral matter, especially phosphates. The two chief varieties are those with, and those without, fat. The latter are mainly eaten in

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* As a rule, it is rapidly digested, but contains less flesh-forming material than the flesh of birds and mammals.

India, and from the absence of natural fat it is necessary to make up for the deficiency by the addition of butter, ghee, fat, or oil during the cooking process. Fish is always best for food when fresh, tough and dry fish is indigestible. The way in which fish is cooked greatly influences its digestibility. The best mode of preparing fish is simply to boil and use some butter and sauce with it. If fresh, fish may be broiled, but *frying* is the worst method if the stomach is weak, or at all out of order.

Beef.—The flesh of the cow is very nourishing, but, being of firm texture, it is less easy of digestion than mutton. The older the animal the denser is its flesh, the harder is it to digest, and the less the nutritive matter it contains. Good butcher's beef has a marbled appearance, due to the streaks of fat between the muscular fibres. Its colour should be neither too bright a red nor too pale a pink. Cow beef is inferior to ox beef.

Mutton.—If mutton is good it is easy of digestion. It is very nutritive, but has less flavour, and is less stimulating than beef. It is best when the sheep is from two to four years old. Goat's flesh is not so nutritive as that of sheep; it is less savoury, and contains a smaller proportion of fat.

Birds.—The flesh of the common or domestic fowl is not digested rapidly, yet it is in no way disagreeable to the stomach, and even those with feeble digestive power can usually manage to partake of it. *Chicken* is one of the first animal foods usually given to convalescent persons.

The flesh of wild birds is easier of digestion, and is less stimulating than that of domestic birds.

All white meats are less stimulating than red coloured fleshes, and they are also less nutritive as a rule.

MILK—*Composition of Milk.*—Each of the bodies entering into the composition of milk is in such proportion, and is so combined, as to form, collectively, the most suitable food for infants. But milk alone is not adapted to the requirements of the healthy adult. To get enough solid nourishment from milk, an adult in moderate exercise would be obliged to drink at least seven pints a day. He would then be taking too much water, and in excess of some, and a deficiency of other, food stuffs. The bodies entering into the composition of milk are.—*Curd* or *caseine* (which forms the chief part of all kinds of cheese); *Cream* (from which butter and ghee are prepared); *Sugar of Milk* or *Lactose*, *Mineral Substances*, and *Water*. We see that each class of food is here represented, and they are in such proportion as to perfectly nourish the quickly-growing infant, the large amount of water helping the rapid chemical and constructive changes going on in its body.

Curd or Caseine is the albuminous or nitrogenous body contained in milk, and is that part of milk from which cheese is made. The albuminous part of fresh milk is not coagulated into a mass by boiling as the white of an egg is; this is owing to the greater quantity of water with which it is combined. The curd is separated from milk by different means, chiefly by the addition of some ferment or acid. *Rennet** is largely used in cheese-making countries, a small bit of it being enough to make 60 lbs. of cheese. Milk coagulates in all stomachs, but it is digested, and the curd thus formed is soft and loose, unless there is some disease of the stomach that creates very acid gastric juice, in which case the curd is in large, indigestible lumps. *Cheese* is mainly composed of curd, but it always contains some of the other constituents of milk. In proportion to the quantity of cream, is the quality of the cheese. Rich cheese contains a lot of cream, whereas that prepared from skimmed milk is of poorer quality; the latter also soon becomes hard and dry.

Cheese is a very nutritious article of diet, but is difficult of digestion. In small quantities, however, it assists the digestion of other foods. The hard variety of cheese requires a powerful stomach to digest it. No description of cheese should ever be given to children, or to those whose digestive organs are weak. Cheese is *very injurious* to delicate stomachs.

Cream represents the fatty element in milk. It consists chiefly of the fatty matter which forms butter; it also contains a small quantity of caseine. It is more easily digested than butter.

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* *Rennet* is the liquor prepared by steeping the inner membrane of a calf's stomach in water, or the membrane itself. Either is used for coagulating milk or converting it into curd in the making of cheese.

When milk is heated the cream rises to the surface. By skimming the cream from time to time, the whole of it may be removed : such skimming materially lessens the nutritive value of milk.

Butter in milk exists in the form of minute globules. When milk is violently shaken up, or "churned," for an hour, the little particles of fat adhere to one another and form a mass called butter. Its composition is much the same as sheep and cow fat, but it is much easier to digest and disagrees less with weak stomachs. It is, in fact, one of the most digestible fats known. We very properly combine it with bread, *chappaties*, rice, and lean animal foods. Butter, like all other animal oils, unless sparingly used, is not congenial to delicate stomachs or to persons subject to "bilious* attacks"; but in proper quantities, when fresh and good, it agrees with people of all ages, from childhood upwards.

When butter is boiled and strained, the resulting product is called *ghee*. Pure ghee consists entirely of fat. It is free from any bad smell, and keeps well : it is also easy of digestion, and is a very valuable addition to many kinds of food.

Sugar of Milk.—The sweet taste of milk is due to the *sugar of milk*, or *lactose*, which it contains.

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* When bile is not properly secreted by the liver from the blood, it accumulates in the system, and in many people produces "biliousness"; in others, a real outburst of sickness, called a "bilious attack," frequently associated with headache, vomiting, and purging of bile, together with slight fever. These attacks are Nature's attempts to get rid of the offending material.

Lactose has a great tendency to change into *lactic acid*, which makes the milk sour, and it is this change which usually causes coagulation of milk.

The mineral matters contained in milk supply salts to the blood, and help to build bone, &c.

Water forms the bulk of milk. It serves as a medium in which all the other constituents of milk are suspended or dissolved.*

The nature of milk depends largely upon the animal from which it is drawn. *Cow's milk* is one of the most important agents as an article of diet for the people of India. In its pure state it can only be digested by people possessed of strong digestion. Cow's milk contains more caseine and fat than human milk, but less sugar; therefore, when a mother is obliged to give cow's milk to the newly-born infant, she should mix it with a little more than half its quantity of water, and add a little sugar, gradually decreasing the quantity of water added. *Goat's milk* is richer and stronger than cow's milk, but does not contain so much sugar. Some people digest it better than they can cow's milk.

Quality of milk.—As milk is so important an article of diet in India, we should be prepared to form an idea as to the quality of any specimen. The quality of milk is influenced by the nature of the food and the condition of the health of the animal yielding it: if both these are good, the milk should be wholesome.

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* When milk is coagulated by an acid, by rennet, or by natural decomposition, the *whey* is left. This consists chiefly of water having dissolved in it the sugar of the milk, and is very fermentable. It forms a cool and nourishing drink.

Characters of good milk.—In estimating the quality of any particular specimen of milk, we have chiefly to rely on the *appearance and the taste of the milk, together with the amount of cream.* Good milk is quite opaque, with a whitish or yellowish white colour; it is free from any peculiar smell or taste, and without any deposit. It should contain about one-tenth its volume of cream, and it should not alter its character by boiling.

Gowlies adopt various means of adulterating milk, the chief of which are, the removal of the cream and the addition of water. To detect these an instrument called a *lactometer* (which shows the specific gravity* of the milk) is used, but, as a rule, it is perfectly useless as a test of the quality of milk.

The water used by *gowlies* to dilute milk is often very impure; if, therefore, we are obliged to buy *bazaar* milk, we ought always to boil it before using.

The only way to secure good milk is to feed the animals and keep them on our premises. The next best way is to have the milk drawn in our presence.

Never put milk into dirty utensils; they rapidly turn the milk sour. The feeding of infants and children on milk out of dirty bottles, cups, and saucers is a frequent cause of diarrhœa, indigestion, and inflammation of the bowels.

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* By *specific gravity* is meant the weight of an equal bulk of different substances compared with some standard of comparison. *Water* is taken as this standard.

Milk rapidly turns sour in the hot weather. This may be prevented by the addition of a few grains of carbonate of soda to the pint, and by boiling.

MILK AS A FOOD FOR INFANTS.—*Nothing is better for infants than mother's milk.*—They should be entirely fed on this until they are seven months old. No mother should nurse her child beyond twelve months; for after that time the nourishment in the milk lessens, and the child is then ill-fed. Further, by continuing to nurse her child beyond this period, the mother unfits herself to carry out this office with future children. Up to the seventh month, or the period when the front teeth are cut, the child cannot digest starchy food or any solid food whatever. We often see young infants being fed on pieces of *chappatie*, *dhall*, and rice. The parents are pleased to find the infant eat such things. Such children soon become ill. Food of this description is not suited to this tender age; it remains in the alimentary tract which it irritates, indigestion, diarrhœa, and other complaints being the result.

Condensed Milk as a Diet for Children.—The use of condensed milk cannot be recommended as a substitute for mother's or cow's milk. In the process of preparation, the milk has been deprived of a large part of its water and some of its fat, and to it has been added about a third of its weight of sugar; it is not, therefore, a model food, as pure milk itself is for the proportion of heat-giving and nitrogenous bodies is excessive. Children certainly often fatten on it rapidly, but from the small quantity of salts it ontains, the bones are not properly formed. Frequently a weak state of body is produced, together with a proneness to disease.

Food of Infants.—In the feeding of infants much good would be effected in their health if the following advice were adopted :—

Until the seventh or eight month (that is, until the front teeth are shed), a child should be fed on nothing but milk. In every posssible case the mother should nurse the child herself. No *conjee*, or starchy food of any description, should be given before this time, because the saliva which is needed to digest starchy food is not up to this age properly formed. The child will often take such starchy food eagerly, and the mother will be satisfied that it is getting sufficient, but she will find that the infant cannot digest it; it will suffer from diarrhœa, inflammation, and other affections of the bowels. In many such cases, although the child takes large quantities of food, it s actually starving. These bad effects do not occur n every case of such improper feeding, but the chances are much in favour of their taking place. After the ninth or tenth month, a little beef tea, chicken broth, and *conjee* may be given, but no solid food of any description until the child is twelve months old. In- ants require to be fed regularly,—for the first month very two or three hours, and then three or four times day, and twice during the night. If the infant is eing fed by the hand, be careful that all utensils sed to contain the milk are kept scrupulously clean.

VEGETABLE NITROGENOUS FOOD.—The food stuffs included under this class are those which contain nitrogenous matter in the form of legumen or *vegetable caseine*, which is always associated with much starch and salts. As examples we have the different varieties of *dhall*, *peas*, *beans*, and *gram* ; they contain a larger quantity of nitrogenous or flesh-forming matter than any of the cereals. Under the name of *dhall* are included three pulses—*tur*, *masur*, *kasari*. *Tur* and *masur dhalls* are largely used in India; they are nutritious, and form a very good food with rice or *chappaties*. As a rule, they are boiled with curry-stuffs and ghee, and made into a curry. They are somewhat difficult to cook, and require to be steeped, boiled, or steamed for some hours before they are fit to be eaten; it is not until the grain, removed from the cooking pot, can be easily crushed to a meal between the fingers, that they are sufficiently cooked.

Gram is largely cultivated in Northern India. When young and green it forms a delicate "vegetable." When mature and dry, it is made into what is called *gram dhall*, and can then be cooked in the same way as *masur* or *tur*, although it requires more prolonged action of heat to completely soften it. Parched gram is largely used by workmen during the middle of the day in Northern India, as at that time they have no means of preparing a proper meal.

Peas, when young and green, contain a large amount of water, and but little nutritive substance, which is chiefly starch and legumen. In the dried state the nature peas are cooked in various ways, but under any ircumstances they require the prolonged action of eat. They are somewhat difficult of digestion, lthough very nutritive, and tend to produce flatuency. They should never be used by people suffering rom disease of the bowels.

Beans, in the young and fresh state, as a food are nuch the same as peas; when ripe they are nutritive, ontaining a large amount of starch and nitrogenous natter. They are more wholesome than peas, and are vell suited to correct the fat of animal food, hence hey are frequently served up with it. They agree vell with those who have to work hard for a living.

Starchy Foods.—Starchy or farinaceous foods are uch as contain a considerable amount of *starch.* These are chiefly the different forms of cereal and eguminous grains, and starchy roots. As examples f such food we have rice, wheat, and potatoes. The nost important are wheaten flour, rice, maize, or Indian corn, potatoes, arrowroot, and sago.

Wheat.—The different varieties of wheaten flour orm the staple article of food of a large part of the eople of India; but it is eaten more in the North-Western Provinces than elsewhere. It is a highly utritive article of diet, is easily digested, and readily repared either into bread or cakes. In composition t consists of 70 per cent. of starch, 11 per cent. of itrogenous matter, and a small amount of salts and at. The ease with which it may be converted into read is due to a substance called *gluten*, which forms he chief part of the nitrogenous matter contained in flour. This gluten is to wheaten flour and to the flour of all cereals what caseine is to milk, or legumen to pulses.

Bread is a staple article of diet, and serves to prevent us from taking too much animal food. It gives volume and proper consistence to the food, and can be used by all except those who have very weak digestions.

There are three kinds of bread : *white bread*, made with flour only ; *wheaten bread*, made with flour mixed with the finer bran ; and *household bread*, made with the whole substance of the wheat grain.

The first of these is the kind of bread made in India, and to prepare it *soojee* or *rolong* is used. Fine white bread is more agreeable than the other kinds, but it is less nourishing ; on the other hand the common coarse bread is much more nutritive and the particles of bran it contains act on the lining membrane of the bowels of some who eat it, and brings about a laxative* effect. White bread, on the contrary, tends to constipate.

The cakes made from *atta* (a coarse wheatened flour) or *chappaties*, are the chief food of the inhabitants of Northern India. They are very nutritious, wholesome, and when well cooked, not difficult of digestion. Frequently ghee or oil is added to these cakes.

Potatoes.—About 75 per cent. of potatoes consist of water, the remainder of starch with a small quantity of salts. Bulk for bulk, therefore, they are much less nutritive than other starchy food. Potatoes should be used with some nitrogenous food as meat, fish, eggs, &c. They should never form the chief part of a meal. They are best when they are boiled in their skins, which keep in the nutritive matter. In boiling they should not be allowed to soak for too long a time. Potatoes cook better by steaming than boiling. They require to be thoroughly masticated before swallowing. Half boiled potatoes are very indigestible.

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* A little looseness of the bowels.

Rice forms the principal food of millions of the inhabitants of India. It contains about 85 parts of starch in 100 parts, and is easy of digestion. From the large quantities that have to be taken to supply enough nourishment to the body, it is usually eaten with stimulating condiments, such as chillies, pepper, &c., to assist its digestion. It can be combined in various ways for food, and is wholesome and well suited for delicate stomachs. Rice contains very little fat; ghee or butter are therefore usually combined with it in some way. Fresh rice is unwholesome, and is said to create diarrhœa, and when boiled forms a pasty lump. It should be, at least, from nine to twelve months old.

Rice water or *conjee* is a useful drink in dysentery or diarrhœa, and in all cases where there is any irritation of the bowels. *Kheer* is a mixture of thoroughly boiled rice and milk; it is very nourishing and easy of digestion.

Sago consists chiefly of starch. It is obtained from the pith of the many species of palm. It is nutritive, easily cooked, and easily digested. In cooking it, we put about a tablespoonful into a pint of hot water, and allow this mixture to remain by the side of the fire for two hours, and boil it for a short time. During the boiling, sugar and milk may be added.

Arrowroot is got from the roots of certain plants grown in America. It consists almost entirely of starch. It is very nutritive, and particularly suited for weak digestions, and those suffering from bowel complaints. It is prepared in much the same way as sago, but does not requre so much cooking.

Millets.—There are several varieties of millet seeds found in India, of which the chief are *bajri*, *javari*, and *ragi*. In composition they are somewhat similar to rice, but more nutritive. They are prepared for food by removing the husk and grinding the grain into a meal, from which cakes are made or porridges prepared.

Indian corn or maize is not very largely used in India. Like wheat, it contains a comparatively large amount of nitrogenous matter, but the bulk is made up of starch. It furnishes a wholesome and nourishing food, well adapted for the support of the labouring classes of India. Bread made from it has a pleasant and agreeable odour. It may be made into a porridge by boiling, but for this purpose it requires to be previously steeped in water for a few hours and boiled for another two.

Fruit.—The great advantages of fruit are due to the *organic acids*[*] they contain, in addition to which are many mineral bodies. All ripe fruits are good to eat, and some serve very useful purposes in the body: they all contain the salts necessary for the blood, and unless taken when unripe, too ripe, or in too large quantities, are very wholesome. Fresh fruits and fresh meat prevent the disease called *scurvy*.* Unripe fruit is always unwholesome; it may cause colic, diarrhœa, indigestion, &c. We should be particularly careful not to eat unripe fruit when cholera is prevalent. Many of the fruits we get in the Deccan are very wholesome, such as oranges, lemons, mangoes, citrons, guavas, custard apples, marsh melons, plantains, grapes, &c. One or two plantains form a useful part of the food of children. They are nutritious, as they contain sugar and starch, and, if properly masticated or chewed, are not difficult to digest.

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[*] Acids which contain carbon, as tartaric, citric, malic, &c.

VEGETABLES.—Green vegetables form an important part of our diet. Like fruits they furnish us with the salts and vegetable acids that are so necessary to keep the blood in a healthy condition. We have mentioned the potato as being a wholesome addition to our food. Other articles are equally good, such as cabbages, cauliflowers, onions, *brinjals*, various forms of sage, carrots, turnips, and beet-root.

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* Scurvy is a more or less chronic disease, characterised by weakness, mental and physical depression, bloated countenance, dark spots or patches on the skin, spongy and bleeding gums, loose teeth, swelling of the legs, &c. The chief remedies for it are fresh animal and vegetable food, liberal use of lime juice and ripe fruits.

Adulteration of Food.—Adulteration of food means the adding to, or taking from, substances used as food or drink, for purposes of gain or deception. This practice has prevailed in all countries from the earliest periods of civilisation.

In purchasing solid or liquid food of any description, we should see that we get the pure article. Defrauding vendors may adulterate by adding other bodies to the article to increase its bulk or give it extra weight, such as adding water to butter or milk, or sand to flour or sugar; or by adding colouring matter to the article to make it more agreeable to the eye, or to prevent the detection of impurities—as pigments added to sweetmeats; or by mixing a cheap and dear form of the same article, as adding used tea-leaves to fresh tea.

Many *buniahs* and other retail dealers in food materials, in order to make quick profits, are in the habit of mixing the genuine article with others of a less costly nature. The bodies added are often of a harmful kind.

Wherever Municipalities exist in India, laws to prevent this form of fraud are in existence. If we purchase an article that is said to be sound, genuine, and pure, yet suspect that it has been previously tampered with, we should seal it up at once in the presence of the vendor and a witness and take it to a police station, so as to have the matter investigated, and the vendor punished, if he is really cheating. With regard to the ordinary *dry foods* in India, experience teaches us that adulterations are rare.

Vendors are becoming aware of the fact that almost every form of adulteration can now be detected either by the microscope, chemically, or by the senses.

The following are a few of the chief adulterations of food in India:—

Ginger.—Turmeric.

Honey.—Flour, sugar-cane.

Lemon-juice.—Sulphuric, tartaric, or citric acid.

Milk.—Water.

Mustard Powder.—Turmeric, wheat-flour.

Sugar.—Sand, flour.

Spices.—Colouring matters, different flours.

Tea.—Exhausted tea leaves, foreign leaves, colouring matters.

Turmeric.—Yellow ochre.

Vinegar.—Sulphuric, tartaric, or citric acid.

Wines.—Water, inferior wines, impure brandy, spirits, various colouring matters.

Arracks.—Water, chilly-powder, burnt sugar.

Arrowroot.—May be mixed with sago, potato, flour, or tapioca.

Bread.—Alum, inferior flour, or mashed potatoes.

Butter.—Water, suet, margarin, colouring matter, &c.

Cheese.—Saffron and other colouring matters.

Cocoa and Chocolate.—Arrowroot of different varieties.

Coffee.—Chicory, roasted wheat, or date seeds, colouring matter.

Curry-powder.—Red lead, brown rice.

Wheat flour.—Inferior flours, as those of rice, potatoes, Indian corn, alum.

BRIEF SKETCH OF THE ANATOMY AND PHYSIOLOGY OF THE DIGESTIVE ORGANS.—When we swallow food, it passes from the back part of the mouth into a pipe which begins at the top part of the throat, and goes all through the trunk of the body. This pipe is called the food canal, *alimentary* or *digestive tract.* From the mouth it passes into the sack-like cavity of the throat, called the *pharynx*, from which it enters the gullet *œsophagus*, or "food-pipe." Below the gullet, the food canal widens out to form a sort of bag or resting place for the food, called the *stomach.* The walls of the stomach contain a large number of small blood vessels, into which the completely dissolved parts of the food passes.

At the far end of the stomach, the pipe again lessens in size and passes onwards; this part is called the *small intestines.* In this division more food passes into the blood vessels through the walls, and in it also there are other little tubes into which another portion of the food enters, called *lacteals.** From these lacteals it passes by a roundabout process to the blood vessels.

Into the upper part of the small intestines open the ducts, which convey the digestive fluids secreted by the liver and sweet-bread or *pancreas.*† At their farther end, the small intestines widen out again to form a continuation of the digestive canal, called the *large intestines*, which serves to contain all the waste matters of the food, and absorb any liquid portion of the food that has not already entered the blood vessels and lacteals.

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* So called because the fluid they contain is like milk.

† The *pancreas* is a long flat glandular organ, situated in the abdominal cavity, somewhat resembling a dog's tongue.

To make such solid bodies as parts of the food are composed of pass through a very fine membrane, it is necessary either to dissolve them in a liquid, or pound them up so fine that the solid particles can pass through or permeate.

From the mouth downwards in man we find a very perfect pounding, dissolving, and melting machinery. We grind our solid food with the teeth, and unless this is properly done, we cannot digest it well, or get the full value out of it. Food that is not well masticated may cause certain forms of disease of the bowels. We often find old people without teeth suffering from diarrhœa and indigestion; such persons should either be supplied with false teeth, or have their food pounded up very fine, before eating it; for, if this is not done, the hard lumps of the food cannot be properly acted upon by the digestive juices. A lot of the food is then wasted, because it is not digested at all. But grinding the food to the smallest visible particles is not sufficient; it must also be dissolved in water. Many things we use as food require only water to dissolve them—salt and sugar, for instance. The solutions so formed can be taken up or absorbed at once by the blood vessels of the stomach and intestines. But many other bodies, such as beef, mutton, vegetables, rice, and bread, will not dissolve in water; they require to be changed by more active agents before they are fit for absorption. These active agents are called the *digestive juices.*

DIGESTIVE JUICES.—These are formed by glands—some small, as those of the stomach and intestines; and others large—as the liver and sweet-bread, and salivary glands. Most of these glands are situated along the alimentary tract, from the mouth to the lowest part of the bowel. We will briefly describe how these juices are formed or *secreted.*

From the mouth to the last part of the bowel there is a thin skin-like tissue called the *mucous membrane.* This membrane is partly made up of a thin tissue called *epithelium*, which is composed of cells; beneath these cells the part is arranged to contain glands, which are the organs that secrete the juices. These glands are surrounded by a layer of very minute blood vessels. The cells of the different glands abstract what they want from the blood, to form their fluid.

Composition of Digestive Juice.—The fluids secreted in all the glands is largely composed of water, which serves to dissolve the solid parts formed by the gland cells. These solid constituents are the active parts of the juices. Some of the juices are acid, some alkalines; some act on one kind of food, some on another. Besides these glands in the mucous membrane of the mouth and intestines, there are other important glands, which pour their fluids into the alimentary tract through little tubes called *ducts* during digestion. These latter glands are those that orm the *saliva* which is secreted by the glands ituated in and about the mouth,—the *pancreas* or weet-bread, which secretes what is called the *ancreatic juice*; the *liver*, which forms the *bile*; and he *glands of the small* intestine itself, which secrete he *intestinal* juice. It is the combined action of the uices of these glands on the food that is called *igestion*.

SALIVARY GLANDS.—The salivary glands are situated in and about the mouth. The fluid they secrete eeps the mouth moist, and allows the tongue to nove freely in speaking. When we eat hard, dry ood, the saliva softens and thereby enables us to wallow it. The chief action of saliva, however, is to *onvert starch into grape sugar*, and as we have already aid, this form of sugar is able to pass into the blood essels in solution. By cooking arrowroot, sago, r any other starch, it becomes thick, sticky and asteless. If we place some of this in the mouth and eep it there for a few minutes, we shall find that he starchy paste has become watery—the starch as become converted into a kind of sugar by the uid poured into the mouth by the salivary glands. his action on starch is not altogether completed in he mouth; it is continued on any undigested starch y the action of the juice formed by the pancreas, hich is situated just below the stomach. As a arge part of the food of children and adults consists f starch, it is necessary that the salivary glands do heir work properly. It is wrong to feed infants on tarch before these glands are well formed. Milk alone should be their food up to the eighth month, at which time enough saliva is secreted to digest a small quantity of starch. If you give starch before that period, it is not digested, but, by fermenting in the stomach and intestines, causes diarrhœa and other bowel complaints.

The Gastric Juice secreted by the stomach rap idly dissolves all *proteid* or meaty substances, and some of the nitrogenous part of vegetable food. If we took a piece of meat and placed it in gastric juice, we would find that the meat would disappear it would all dissolve, except the fat and the shreddy covering of the muscle fibres. In this dissolved state it is ready to enter the blood, and is taken up by the blood vessels. The juice secreted by the pancreas, called the *pancreatic* juice, in addition to acting on starches like saliva, acts on fleshy substances in the same way that the gastric juice does, and it will also help bile to split up fats and prepare them for entering the *lacteals.* These are vessels which take up a milk-like substance from the small intestines. This milk-like material enters th lacteals, and then passes into larger similar vessels which end eventually in a vein at the bottom of th neck, and thus the fats and some other bodies ar at length conveyed to the blood.

We see that *starches* are converted into sugar i the mouth by the saliva, and in the small intestines by the pancreatic fluid. This sugar rapidly passe through the mucous membrane, and so into the bloo capillaries of the walls of the digestive canal. Thus all the good parts of starch and all the sugar we eat pass at once into the blood.

Proteid, meaty, or fleshy foods are dissolved in both the gastric and pancreatic juices; the dissolved part readily passes into the blood vessels.

The *fat* cells are broken up by the stomach, their envelope dissolved, and the fat globules set free. The bile and pancreatic juice splits these into much smaller globules, and these tiny particles of fat pass into the lacteals and then into the blood.

The *mineral matters* of the food are dissolved by all the juices, and pass at once into the blood.

Water passes into the blood vessels along the entire digestive tract.

Let us follow a piece of bread and meat through the food canal. *Bread or chappaties* consist largely of starch. While we are masticating a piece of bread, it is becoming moistened by the saliva and some of the starch is changed into sugar. All of it is softened and partly broken up. In the stomach the vegetable proteids of the bread are dissolved, and they, with the newly-formed sugar, enter the blood vessels. The part not acted on is converted into a pulp, called *chyne*, which passes into the small intestines, and is there acted on by the juices of the small intestine and pancreas, where it is dissolved and finds its way into the liver, and then into the heart and general circulation. The greater part of the proteid or albuminous matter of bread is not digested, but passes out of the bowel.

A piece of meat is first broken up into little masses by the teeth, and moistened by the saliva, but undergoes no other change in the mouth. In the stomach the proteids rapidly disappear under the action of the gastric juice; the little masses of meat soften, the fibres of the muscle break short off and come asunder, the fat of the meat is set free from the little cells in which it was stowed, and melts under the heat of the stomach. Most of the dissolved proteid material is absorbed; the remainder passes into the small intestine, and is acted on by the bile and pancreatic juice; these convert the fats into a sort of soapy emulsion, in which form it is absorbed. When all these products are mixed together, we have formed a kind of yellowish cream-like material, which is passed along the bowel by the muscular coats contracting; and, little by little, all the good material is taken up by the blood vessels along the entire alimentary tract. At last, nothing is left but the indigestible coverings of the starch granules and broken fibres of hard animal and vegetable tissue, which are cast away.

Teeth.—The teeth are provided us for the purposes of cutting and grinding our food. It is necessary that we take every precaution to preserve them in a sound state.

Decay of the teeth is chiefly caused by portions of the food which become entangled between them; these particles of food, from the heat and moisture of the mouth, rapidly decompose. Further, as the saliva evaporates, it leaves a deposit on the teeth called *tartar*. This tartar rapidly collects organic matter, and this organic matter, under the influence of vegetable germs (that are always loitering about the mouth), putrefies, and in this putrefaction destroys the teeth. The use of sweets in excess also tends to bring about decay of the teeth, for the sugar of the sweets is changed into an acid which acts upon the hard covering of the tooth and wears it away. Acid beverages (especially if they are strong) have much the same effect.

Preservation of Teeth.—Young children should be taught to brush their teeth with tepid water, once a day at least; they should also be advised to remove all particles of food that have lodged between the teeth with a quill or a *wooden* toothpick. We should not use sharp-pointed metallic intruments for this purpose.

The hard covering of the tooth or *enamel*, if once injured, is not restored, and the whole substance of the tooth is then exposed to decay.

We should not crack hard nuts with the teeth, nor should we bite thread or use gritty tooth powders.

PAN CHEWING.—We should caution those who are addicted to the habit of chewing *pan* as to its filthiness and its liability to bring about *ulcers** in the mouth. In old people this habit may often be the starting point of cancer† of the lip or tongue. On the other hand, some people think it preserves the teeth and hardens the gums. We doubt if it really has any such beneficial effect.

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* An ulcer is a solution of continuity on any of the soft parts of the body forming purulent matter, or more simply a "sore" discharging pus.

† *Cancer* is a malignant growth or structure in some part of the human body, which can extend itself and spread to neighbouring parts, and even form again after removal, and usually causes death.

MAN IS BOTH A VEGETABLE AND FLESH EATER.—Different animals live on different kinds of food. Some live on *vegetables* entirely (*herbivorous animals*), others altogether on *fleshy* food (*carnivorous* animals). We notice that the tiger, who is carnivorous, is furnished with long pointed *canine* or eye teeth for tearing with, and that its back teeth have sharp cutting edges: one of the teeth has a largish crown for crushing with. The cow, which lives entirely on the products of the vegetable kingdom, is provided with teeth suitable for the purpose of pounding or crushing. In man we have a set of teeth that combines the qualities of herbivorous and carnivorous animals. Our front incisor, or biting teeth, and our canine or tearing teeth, are not well formed, but the crushing teeth are well developed. Man, then, is omnivorous, that is, he lives on both animal and vegetable food.

Animals that live on the flesh of other animals have very small and simple stomachs. Those that live on vegetables have a complex and extensive food-canal, because vegetable food is more difficult to dissolve than fleshy food. The cow and the sheep have four stomachs. We possess a stomach mid-way between these two classes of animals, showing that we require a variety of food. By a proper mixture of vegetable articles, we can live on them alone; there are, in fact, millions of Hindus and others who live almost entirely on the produce of the Vegetable Kingdom. We must be supplied with nitrogenous food, and this is contained in the *atta* and *dhall* consumed by Hindus. But to get enough nitrogenous material out of these bodies, a large amount must be eaten. It is much more convenient to combine some fleshy material with the diet. *Pure white flour* is insufficient to support life, as in it the outer layers of the grain and husk which contain the nitrogenous matter have been removed in the preparation of the flour. A dog fed only on bread made from pure white flour lives for a much shorter time than one fed on flour made from the entire grain. *Atta* is a more nourishing body than white flour, as it has in it the husk, &c., which contains the nitrogen. The body containing the nitrogen is called *vegetable caseine*, which is similar to the substance which makes up the mass of cheese.

The bodies of the higher animals having the same composition as that of man, we might infer that by eating their flesh we could secure all that is necessary for our nourishment. And this is so, if the flesh chosen contains the proper proportion of the different kinds of food stuffs we require—nitrogenous fat, starch, salts, and water. A certain amount of these items is necessary to keep up the bodily warmth, and to repair the wear and tear of the tissues. The proportion of nitrogen to carbon required in the body is 1 to 30. The proportion of these two elements contained in beef is 1 to 15; therefore, on beef alone we could not supply these elements in proper proportions.

EFFECTS OF EATING RAPIDLY.—We ought to take time in eating our food. By "bolting," or imperfectly chewing our food before swallowing it, we do not give time for the saliva to mix with it properly: the coarse pieces of food that are thus swallowed resist the action of the digestive juices. Quick eating leads to over-eating and over-loading of the stomach. We do not, then, really know the quantity we have eaten until we feel a fulness about the stomach. This habit finally leads to indigestion and a train of other evils.

Quantity of Food.—The quantity of food required to keep the vital processes in action in health varies with the age. sex, occupation, habits of the individual, and with the climate.

The diet of children should be relatively more abundant than that of adults. They should be given those things that are nourishing, and quickly and easily digested. All hard, heavy, and rough things are difficult to digest. Children cannot grind them thoroughly by the teeth, therefore the stomach cannot assimilate them. Some children are always eating sweets, biscuits, fruit, &c., between meals; this habit is bad, and takes away the appetite for wholesome food.

Adult females require less food than males. A sedentary calling needs less food than an out-door life. A laborious occupation calls for a supply of force-producing food, such as fatty material and starches with a sufficiency of animal food.

The *season* should also cause us to modify our diet. In winter we require carbonaceous food and more meat than in summer. In the hot weather we should take less fatty and starchy food, but more fruit and green vegetables.

Climate also has its necessities. The people living near the North Pole have a great liking for fat and oils. In India and other tropical regions, the diet should consist of more vegetable than animal matter, *i.e.*, it should be less stimulating.

MEALS.—*Periods of Day for taking them.*—We cannot lay down any fixed rules as to the hours of the day at which meals should be taken or the number of meals to be consumed. These points are regulated by convenience, occupation, and caste; we shall therefore confine ourselves to a few general remarks.

As a rule, we ought not to take more than three meals a day, and most people are better with two. We would condemn the custom of eating "little and often." The stomach, like all other organs, requires intervals of rest.

With children, at least, three hours must intervene between meals, and in adults four to five hours. This does not, of course, apply to invalids, convalescents, and sick people generally, as they require to be fed oftener and in small quantities.

Between the periods of the ordinary meals nothing should be eaten. Remember that in children the vital processes are more active and rapid than in adults, hence the necessity of feeding them more frequently. The time of taking the last meal is regulated by habit and occupation. As a rule, it should not be later than seven o'clock in the evening. With most people, an hour earlier would agree better. Some people take supper before retiring. This is generally a bad habit in India. Adults may, however, in this matter be guided by personal experience. Certainly, no heavy food should be eaten immediately before going to bed.

How Meals should be taken.—Meal times should be the happiest of the day. All care and grief impair the appetite and hamper digestion. Cheerfulness is very desirable during these periods. It was intended by Nature that we should enjoy eating, since a sense of taste has been provided us.

Exercise before and after Meals.—As soon as food is eaten, the digestive tract is at once supplied with an extra quantity of blood, partly at the expense of the other organs of the body. We should not therefore undertake any hard study, labour, or exercise immediately before or after meals. We should give the stomach, at least, half an hour's rest at these periods. Active exercise immediately after a meal disturbs digestion. But persons in health may take a gentle walk, or do anything that does not require severe exertion. When the active part of digestion is over, we feel once more invigorated and fit for exercise. This period is about one and a half hours after meals. Never eat a full meal when in a state of bodily fatigue, as in this condition the digestive process is slow.

Variety of Food is Necessary.—Few things impair our appetite so much as sameness of diet. Nature has provided a great variety of food for us, and we should take advantage of her blessings. By the wonderful processes of *assimilation*, *metabolism*,* *and nutrition*,† food is changed into flesh and blood. Say, we eat a meal of meat, vegetables, and some liquid; the former two are ground by the teeth, mixed with the saliva, and all are churned and dissolved by the digestive fluids, absorbed by vessels of the stomach, and, finally, swept through the body as blood. As the blood passes it, each organ takes up its special food. Within the cells of the organs it is altered into different forms of protoplasmic matter—hard bone for instance, or soft, delicate brain tissue, into tears, perspiration, into bile for digestion, oil for the hair, or nails for the fingers.

ALCOHOLIC BEVERAGES.—*Production of Alcohol.*—The active agent in all intoxicating beverages is *alcohol.* Chemically, alcohol consists of certain proportions of carbon, hydrogen, and oxygen. Sugar also consists of carbon, hydrogen, and oxygen. Any substance containing sugar, such as the juices of fruit and certain vegetables, may be caused to ferment; and in the process of fermentation, these elements (carbon, hydrogen, and oxygen) re-arrange themselves in such a way that alcohol and certain other bodies—volatile oils and others—are produced: a wine or spirit is the result. In this, the alcohol is the intoxicating body; the other agents contained in the liquor give it its peculiar flavour or aroma. *Wine* is the fermented juice of the grape; *Toddy* is the fermented juice or sap of various species of palm.

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* The term *metabolism* is applied physiologically to the different phenomena which result from the chemical changes in animal cells or in the substance surrounding cells.

† *Nutrition* is the assimilation of nutritive material to our organs and tissues. *Assimilation* is the converting of food into nutriment by the digestive functions.

Effects of Alcohol.—The effects of alcohol vary chiefly with the quantity and the form taken. The first effect of any alcoholic beverage is that of a stimulant. If taken in small quantities, some of it is at once absorbed by the blood vessels of the stomach, and soon conveyed all over the body. It excites the action of the heart, which pours larger quantities of blood into the brain and other organs. Further, by dilating the smaller vessels of the skin, and allowing a larger amount of blood to flow near the surface of the body, a feeling of general warmth is produced. The red face of those who are constantly taking alcohol is due to the dilated condition of the vessels of the skin. But no fresh heat is developed: the contrary is the case, for more blood being in the surface, more heat is lost by evaporation and radiation; the blood, therefore, cools faster than usual. Reaction sets in, by which a chilliness is felt, and at this stage, instead of the temperature of the body being normal (98°4 Farh.), we may find it at 97 or even 96° Farh., and it will be several hours before the natural temperature is reached again. Liquor, then, does not fortify us against cold. The habit of taking a "glass of grog" before going out into the cold air is based on an erroneous idea. In the report on the Arctic exploration, Dr. Hayes wrote: "Alcohol in any shape is not only completely useless but positively injurious in preventing the effects of cold. I have known strong, able-bodied men to become utterly incapable of resisting cold in consequence of long-continued use of alcoholic drinks." Succeeding the stimulation of alcohol, there is always a depression.

Large quantities of alcohol (such as are taken during a drunken bout) act upon the brain and spinal cord in such a way that the imbiber cannot any longer control the action of the voluntary muscles. The movements are then disorderly and weak; the person cannot walk steadily; he staggers and reels about. This is the second stage, and is succeeded by a third, in which the mental faculties are so deranged that no reasoning power remains. The speech is then difficult, the voice is thick, husky, and broken; all steady, voluntary movement is lost. A fourth stage follows in which the brain is principally involved. We have now an entire depression of the muscular and nervous systems, the imbiber lies like an insensible mass—he is "dead drunk."

Effects of Alcohol on Digestion.—When a small amount of any very diluted alcoholic beverage is drunk, it causes an increased flow of gastric juice. The effect of this is to cause the food to be more rapidly and thoroughly digested. On the other hand, if any strong alcoholic beverage is taken with the food, it tends to destroy the activity of the gastric juice, for by it the *pepsin** is thrown down and rendered useless. Without pepsin we know that gastric digestion cannot go on. Further, alcohol unites with water very greedily, and when taken on an empty stomach, absorbs the moisture from the tissues, irritates them, and eventually produces inflammation of the mucous membrane of the digestive tract. If such inflammation goes on for any length of time, the glands of the stomach cease to secrete gastric juice and the food then is not digested. Many of the diseases of the stomach from which some adults suffer are due to the excessive use of alcohol.

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* *Pepsin* is the ferment substance and active principle of the gastric juice, which digests the proteid substances ingested, forming what are called *peptones.* A peptone is a proteid solution obtained by digestion, natural or artificial.

Alcohol lessens the power of undergoing severe bodily exertion ; it does not impart strength. Those who are going through a system of training for competitive feats, requiring strength and physical endurance, such as walking, running, rowing, &c., eschew all liquors, even if they have been previously accustomed to them.

Many people consider that small quantities of alcohol, repeatedly taken, act as stimulants to the brain. Such stimulation is very temporary, and it is now a well-known fact that the highest brain powers are never called forth under the influence of alcoholic stimulants.

It has occasionally occurred that persons have fallen dead from the effects of a large quantity of alcohol, suddenly imbibed.

Alcohol creates a craving for itself.—When any form of alcoholic beverage is indulged in, if even in small quantities, a time quickly arrives when we cannot do without it, or can only do without it by a great effort of self-denial. Further, there is a constant yearning for an ever-increasing amount of the liquor to produce the original effect. Now, such a craving is unnatural. No food brings about this ever-increasing desire. If we drink a cup or two of milk for breakfast, we have no wish to drink more, nor does the appetite for milk increase; it will never create a masterly control over our inclinations. In a large number of cases, this is the effect produced by alcohol. Hunger is appeased by a sufficiency of food. The craving for alcoholic beverages is only satisfied by an ever-increasing quantity of some alcoholic drink—a morbid craving that must be satisfied at any price. We would caution our young readers to beware of the first glass of any form of intoxicating liquor.

One of the gravest influences of the alcoholic habit is, that it frequently transmits the craving for alcohol to the offspring. This is the explanation of some of the cases of *alcoholism** met with in the young. Parents ought to be very watchful with regard to the quantity of alcoholic liquors or beverages they indulge in.

Alcohol lessens the Appetite for other Foods.—One of the chief influences of alcohol is to decrease the waste of the system, and this is in part shown by the lessening of the amount of carbonic acid gas given out by the lungs. Normally, our tissues are constantly undergoing change: every tissue and organ is being incessantly broken down and re-built with the materials provided from the food. This process is chiefly one of oxidation. If this oxidation of the tissues or organs is checked, or new tissues are prevented from being formed, the functions of the animal economy cannot be carried out properly. Under alcohol the blood contains less oxygen, but more carbonic acid than normal; therefore, the power of using up the food eaten is decreased, and as a result the waste and repair is proportionately lessened. The drunkard, or "tippler," eats less animal and vegetable food, as a rule, than the ordinary man, because to him his alcoholic beverage appears to be a food. This idea is founded on error. The alcohol has in reality lessened his appetite and the functions of the digestive tract.

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* *Alcoholism* is a diseased state of the body, especially of the nervous system, brought about by the immoderate use of alcoholic liquors.

Alcohol is not a Food.—Alcohol contains nothing that can be converted into any tissue of the body. It cannot enter into the construction of brain, nerve, muscle, or blood, although it might interfere with their repair.

What constitutes excessive use of Alcohol?—Alcohol is the dangerous agent contained in alcoholic beverages. Experiments have shown that an adult man, in moderate exercise, cannot use up more than 1½ ounces of alcohol within twenty-four hours. When the amount of alcohol is increased to, or beyond, 2 ounces of absolute alcohol in the day, *excess is reached.* The strength of the body is decreased, nutrition is rendered defective, and such alterations may take place in the body as lead to disease of the liver, lungs, or kidneys. Any amount, therefore, exceeding 1½ ounces of alcohol a day constitutes an excess.

The following table, from Dr. Pelley's *Hygiene*, shows the relative quantity of absolute alcohol contained in the ordinary fermented drinks of England and the Continent of Europe:—

Drinks.	Percentage of absolute alcohol.	Average percentage of absolute alcohol.	Quantity representing about one ounce of absolute alcohol.
Malt Liquors.			
Ale	1·2 to 10	5	20 ounces or one imperial pint.
Beer			
Porter			
Stout			
Light Wines.			
Rhine Wines ..	6·8 to 12	10	10 ounces or half an imperial pint.
French Clarets ...	6·8 ,, 12		
Burgundies ...	6 0 ,, 13·3		
Rhone	8·5 ,, 13·5		
Strong Wines.			
Madeira	17 to 21	20	5 ounces or 2 ordinary wineglasses.
Port...	17 ,, 22		
Sherry	16 ,, 24		
Spirits.			
Gin	40 to 60	50	2 ounces or 1 ordinary wineglass.
Whisky	50 ,, 60		
Brandy	53 ,, 60		
Rum	60 ,, 75		

Alcohol unnecessary in Health.—We do not need, and should not take, any alcoholic beverage when we are in health. Some people, however, from delicate constitution, weak digestive organs, or for some other reason, find, by experience, that a small amount of some fermented liquor does them good, and is necessary to their well-being. In such cases the quantity and the nature of the beverage to be used ought to be at first prescribed by a medical man: but under no circumstances should the quantity of the beverage used in the day contain more than an ounce and a half of absolute alcohol.

During sickness there is sometimes occasion to use an alcoholic stimulant for a time. No rules can be laid down for these cases, but under such circumstances they ought never to be taken unless prescribed by a doctor. When the occasion for their use ceases to exist, they should be stopped. At such times they are taken only as medicines, and, like medicines, the quantity, quality, and time, should be entirely regulated by the doctor. The following general conclusions regarding the use of alcohol under different circumstances are based upon the experience of great authorities. If these rules were generally observed, alcohol would cease to play the part it now does in the derangement of health and constitution, and in the production of crime and vice—the physical, social, and moral dangers connected with excessive drinking would, in short, cease to exist:—

(1) The use of alcohol is unnecessary in health;

its habitual use tends to produce disease; it is much better to avoid it altogether.

(2) In some cases, it is necessary to the well-being: in such people it must be taken with the utmost care. With regard to the quantity of beverage used, this must be the least possible, and ought never to exceed that containing one and a half ounce of absolute alcohol a day. Further, this alcohol should always be diluted, and in a state of intimate union with the other constituents of the beverage. All wines containing more than 10 per cent. of alcohol should be diluted before being drunk. The beverage should always be taken with meals, and preferably only with dinner, never in the morning or between meals.

(3) If occasion arises to use any alcoholic beverage for a time, it should be stopped as soon as the need for it no longer exists.

Alcohol is answerable for many deaths that take place in India annually. Accidents frequently arise from intoxicated people falling into wells, down precipices, from drowning, &c. Drunken men frequently lie on the ground all night, catch cold, and as a result suffer from serious diseases. Further, during fits of drunkenness, or under the abnormal* stimulation of alcohol, murders are often committed. Drunkards occasionally end their days in a lunatic asylum.

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* *Abnormal* means contrary to the natural condition, unnatural.

The following is a brief description of a few of the bazar liquors met with and most frequently drunk in India:—

Toddy or Palm Wine.—The sap of a number of palm trees* contains much sugar. The juice ferments spontaneously if allowed to stand for a few hours, and converts the previously harmless, cooling, and refreshing fluid, into an intoxicating drink.

It is advisable never to use this fermented drink.

Fermented Toddy is also used in the production of *Arrack*, by distillation. This distilled liquor is as strong as brandy.

Arrack is one of the most frequently used intoxicating liquors in India. It is an almost colourless liquid, with a sharp, but not unpleasant, taste. It is prepared by the distillation of the sweet juices of many plants, but those of the palm tree and *mahwa* flowers are chiefly used. In the case of the latter, a very intoxicating liquid is prepared from the fleshy petals (which contain sugar) by distillation.

The ordinary arrack of India is a spirit distilled from fermented rice.

Parriah or Common Arrack is a very unwholesome and intoxicating liquid. It is often prepared from coarse *jaggery*, spoilt toddy, bad rice, &c., and is made more intoxicating by the addition of hemp leaves

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* For the abstraction of toddy, the cocoanut palm is chiefly used.

(*churus*), poppy-heads (opium), the juice of stramonium (*dhatura*), and other bodies. Certain classes of Hindus consume this largely.

Most forms of intoxicating liquors, and particularly those of bazaar manufacture, are impure, often containing other poisons besides that of alcohol. In the case of toddy, the addition of the water almost always used to adulterate the liquid would be an advantage, were it not that this water is frequently got from dirty ditches, pools, or bad wells.

HABITUAL USE OF OPIUM.—*Opium* is the dried juice of the poppy head. In India the opium poppy plant is cultivated on a large scale, for the production of this drug. When a cut is made in the poppy head, a small drop of a milky juice oozes out, hardens, and assumes a dark colour. These hardened particles are then gathered into masses, which are sold. An acre of land is said to yield about 25 lbs. of opium.

Opium is a narcotic* poison that is used habitually by millions of people in India, and China, and other parts of the East. In most Eastern countries opium is smoked, but in Western countries it is drunk or eaten in the form of *laudanum*† or *morphine*.‡

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* *Narcotic* is a term applied to medicines that produce sleep.

† *Laudanum* is another name for tincture of opium. It contains one grain of opium in about 14½ minims.

‡ *Morphine* is a powerful and poisonous alkaloid contained in opium.

Effects of Opium.—The practice of opium-eating prevails very generally in India. Opium acts directly upon the nervous system, a small dose relieving pain, a large one causing sleep. Small doses for the time stimulate the mental faculties; following this there is a reaction which brings on much depression, both bodily and mental, to relieve which the opium-eater takes some more of the drug. The quantity taken to stimulate the brain and system generally must be gradually increased to produce the former pleasant sensations. The seductive influence of the drug leads the victim on by slow degrees, until he finds that he cannot do without it. At this stage it requires the most fixed resolution to shun it. In trying to break the habit of opium-eating, the unfortunate user of the drug goes through severe agony, the craving for opium being more lasting and terrible than that for any other stimulant. Yet this is worth going through, for to continue in this dreadful habit means to wreck the mental and physical abilities as long as life lasts. By it the functions of all the organs of the body appear to be interfered with. Digestion is weakened, appetite becomes less, the food is not relished, the muscles of the body waste, the skin dries and shrivels, the activity of the nervous centres is lessened, and the wretched being becomes prematurely old.

We would urge all, in the strongest terms, *never to begin the habit of Opium eating.* No person can be too careful in the use of any preparation of opium: no habit is so easily acquired, nor so hard to give up, as that of opium eating or smoking. Never use any form of opium unless it is prescribed by a doctor.

INDIAN HEMP OR CANNABIS INDICA.—The Indian hemp plant is cultivated in India, and used by millions of the inhabitants habitually, on account of its stimulating and narcotic properties. It is used in many forms for this purpose—smoked, drunk, and eaten. *Ganjah* is the dried flowering tops of the female plant; *Churrus* is the resin-like and hardened juice got from the leaves, stems, and flowers; *bang*, *subjee*, or *sidhee*, is the larger leaves and capsules without the stalks.*

Effects of Indian Hemp.—The effects of any form of the drug are, for a short time, agreeable. It is supposed to blot out all ideas of time and distance, and to exalt the imagination in many ways; but the effects vary in different people. The word "assassin" is said to be derived from the fact that some individuals under the influence of *hashish*† are inclined to rave furiously, to threaten to, and often actually commit, murder. Many murders in India have been committed under its influence.

In some people it causes intense anguish for hours. The habit of using Indian hemp as a stimulant and narcotic is very dangerous, and should never be commenced; its continuous use often leads to insanity.

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* WARNING'S *Therapeutics*, IV. Ed., p. 138.

† *Hashish* is the Arabic word for an inebriating fluid prepared from the powder of the leaves of the Indian Hemp

HABITUAL USE OF TOBACCO—*What Tobacco contains.*—The bodies contained in tobacco are numerous, but the most important ones are,—*nicotine*, carbonic acid, carbon non-oxide, carbon or soot, and ammonia. The amount of these substances varies in different kinds of tobacco. They also vary with the way in which it is smoked, the kind of pipe or cigar used, and the rapidity of the burning of the tobacco.

Carbonic acid tends to bring on sleepiness and headache; *carbon non-oxide* also produces headache, but in addition causes a tremulous movement of the muscles, and at times of the heart also. *Ammonia* gives the hot sensation to the tongue felt by the smoker; it excites the secretion of saliva at first, and then causes dryness of the mouth and throat. *Nicotine* is a powerful poison, so much so, indeed, that the amount contained in two strong cigars, if thrown suddenly into the blood, would prove fatal. Nicotine is a complex body, giving up a volatile substance, to which is due the peculiar and strong smell given to the clothes and breath of the smoker. Nicotine also contains a bitter extractive body, which gives the sickening taste to an old pipe. In smoking, some of the nicotine is decomposed, and forms other complex and poisonous bodies.

Effects of Tobacco-smoking and Chewing.—When tobacco is smoked or "chewed" for the first time, some of the poisonous nicotine rapidly enters the blood and affects the system. Nausea and vomiting are produced, the stomach trying to get rid of the offending substance; the circulation of the blood is disturbed, especially in the brain, and headache comes on followed by giddiness. Nature is now protesting against the habitual use of tobacco. After repeated attempts, the system appears in a way to become accustomed to the poison, and then smoking causes none of the former symptoms. Such a powerful poison as nicotine, however, cannot be constantly inhaled without bringing about bad effects. We know that the lungs, the skin, and the kidneys throw off much of the poisonous products of tobacco, but we also know that much of these remain in the system.

Those who are actively engaged in out-door work will not show signs of poisoning by nicotine ; while those who lead sedentary lives, particularly the hard brain worker who is at the desk all day, will sooner or later be affected. He at length suffers from dyspepsia, sleeplessness, nervousness, palpitation* of the heart, and other troubles. It is stated by some medical authorities "that the children of great smokers are often very nervous."

Tobacco is not a Food.—Tobacco as a food is altogether a negative body. It gives no nutritive matter to the brain. Instead of improving, it tends to derange the vital processes. It does not, as a rule, assist the working of the brain, although in some cases it appears to act as a slight stimulant to that organ.

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* *Palpitation* is a violent, irregular, and unnaturally rapid beating of the heart. Ordinarily, we are unconscious of the heart's action, but during palpitation we become painfully conscious of it. Palpitation is very distressing whilst it lasts.

Influence of Tobacco on Youth.—Experience teaches us that the habitual use of tobacco in early life retards the devolopment of mind and body. The growing and maturing body cannot tolerate any such disturbances of nutrition as are brought about by tobacco-smoking. In the boy we find this habit disturbing digestion, causing the heart to beat excessively, preventing oxidation of the blood, interfering with assimilation, and deranging the nervous system.

The habit of smoking should never be commenced. The lad who takes to it, works at his books at a disadvantage compared with non-smoking youths; he, by smoking, decreases his mental and physical powers.

The habit once acquired is often stronger than the will, so that the smoker may not be able to stop it. Further, smoking is an expensive practice. But another danger attaches to tobacco-smoking; it causes thirst and depression, to overcome which too frequently alcoholic liquors are drunk.

CHAPTER VI.

HUMAN EXCREMENT, SEWAGE, AND LIQUID REFUSE.

Composition of Sewage—Quantity of Human refuse to be dealt with—Diseases created by Human ordure—Methods of removal of Human excreta—Village Latrines—Utilisation of Human refuse—Final disposal of Human excrement—Public Latrines—Private Latrines—Difficulties of removal of Human ordure from Gosha Latrines.

IT is a matter of the utmost importance to health, that all discharges from the bowels* and kidneys† should be got rid of as speedily as possible. We shall see that this is one of the gravest and most difficult questions in the practical sanitation of large towns and cities in India. In small villages, where houses are more or less scattered, the community small, and the greater part of the people resort to the fields to perform the offices of nature, the question of removal of human refuse is, perhaps, associated with fewer evils; but in the case of large towns and cities, the removal of human ordure‡ becomes really a matter of life and death. We must remember that it is not until human ordure begins to decompose[*] that it is so very injurious. The period when this decomposition sets in varies with the season of the year, and particularly depends upon whether liquid excrement has mixed with it or not; in this latter case putrefaction[†] rapidly ensues. It behoves us to get rid of these discharges, then, before this putrefaction arises. People have been killed by the concentrated foul gases given off by putrefying human filth. The same might arise from a suddenly opened up *sundass*.[‡] The severe epidemics of "Plague" and other diseases that prevailed in Europe, and also in India, a few hundred years ago, were largely due to neglect in the removal of human excrement.

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* The *bowels* are formed of that part of the alimentary tract situated below the food-pipe.

† The *kidneys* are the organs that secrete the urine. They are two in number, and are situated at the back part of the abdominal cavity. Each kidney has a duct, by means of which it is brought into communication with the bladder.

‡ *Ordure or fæces* is the excrementitious part evacuated by animals. The major part consists of the unassimilable, or undigested parts of the food, on which the digestive process has no effect, and other portions that are nutritious, but have escaped digestion. There are also certain waste matters of the bowels contained in it. The fæces of different animals vary with the diet.

COMPOSITION OF SEWAGE.—The term sewage, strictly applied, refers only to the fluid and material that flows in underground pipes or *sewers* found in a few large towns in India. It is convenient, however, to apply the term to human refuse generally. We consider, then, that it consists of all the liquid refuse of human dwellings that is liable to affect our health. Sewage is a very complex liquid, varying much in its nature. The two most offensive agents in its composition are those of human excrement—urine and fæces; but mixed with these there is the foul water of houses, containing animal and vegetable, and other refuse matters; it also contains the drainage fluids from stables, cow-houses, slaughter-houses, and manufactories. In towns where sewers exist, the mixture of all these matters is allowed to flow in large underground tubes, called sewers; but in many places, especially in inland cities and towns in India, it is necessary to make special provision for the removal of human ordure and urine separately from the other refuse liquids. This is because the conditions necessary to carry out the underground sewage system are wanting.

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[*] *Decomposition* is the separation of the constituents of a body from one another. Spontaneous decomposition takes place in organic bodies very rapidly, unless special precautions be taken to prevent it. All organised matter, such as animal tissues, organic fluids (such as blood and milk), and all complex bodies (such as albumen, gelatine, &c.), decompose very rapidly if exposed to air, and this decomposition is brought about by minute vegetable germs, called *bacteria*.

[†] *Putrefaction* is the spontaneous decomposition of organic substances, accompanied by the evolution of fœtid and noxious gases; it is a species of fermentation. As animal matter contains more nitrogen than vegetable, in its putrefaction it gives rise to more offensive products, especially compounds of ammonia. Putrefaction is caused by the presence of germs contained in ordinary air.

[‡] A *sundass* is a well privy brought into communication with the house by means of an underground channel or pipe. Sometimes, this well is sunk immediately under the place where the user sits.

QUANTITY OF HUMAN REFUSE TO BE DEALT WITH.—It will be well to consider, first, the quantity of material that we have to deal with in this removal. On an average, an adult passes about five or six ounces of fæces, except vegetable feeders (chiefly Hindus), who discharge ten to eleven ounces daily. Taking age and sex into consideration, the amount per head of population, in India, would be about four ounces per diem. Of urine, about fifty ounces are passed a day, or, on an average for all ages, about forty ounces. We, therefore, have forty-four ounces for each person for every day of the year to get rid of. Taking the population of a town as 20,000 souls, there would be 670 maunds of excreta per day, or 244,550 maunds a year to be dealt with. The effects of having such a collection of filth in and around houses are of the most dangerous nature. What would be the state of such a town in five years, if no provisions for filth removal were made? If all the inhabitants resorted to the fields remote from human dwellings, as they do in the villages, probably very little harm would ensue. We must remember that in large towns this is not the practice. In such places. human excrement is deposited in and around densely-crowded and over-populated areas. We are acquainted with certain places where provisions for the removal of accumulated human filth *have never been made.*

DISEASES CREATED BY HUMAN ORDURE.—In the present day many of the diseases that occur in the large towns of India are due to imperfect removal of the waste matters of the inhabitants. Foremost amongst these are *cholera*, *typhoid or bowel fever*, *diarrhœa*, *dysentery*, and *sore throat.* With regard to cholera we have enough proof to show that the poison of the disease is contained in the discharges of people attacked. If these discharges, therefore, gain access to the body, either by mixing with drinking water or through the air, or in any other way, they are liable to bring about cholera. It behoves us to thoroughly destroy, by *disinfection*, whatever passes from the bowels of such cases, and then have the material buried at a considerable distance from all houses, wells, and water-courses.

Typhoid, Enteric, or Bowel Fever does not affect the people of India to the same extent that it does the Europeans coming to the country. A large number of young British soldiers are yearly attacked with this disease; in fact, it causes among them a greater mortality than does any other disease. It is considered by most authorities that the poison of enteric fever is a specific one, and that it is contained in the discharges of patients suffering from that disease. Others believe that decomposing and putrid human ordure is in itself sufficient, without any specific poison.* Many of us know, from personal experience, that *diarrhœa* may arise from foul emanations from filth collections. *Dysentery*, likewise, may be caused by the foul gases given off from human excrement, and particularly is this so when the excrement is from dysenteric cases. We do not mean by this that ordinary dysentery is infectious; what is meant is, that certain forms of dysentery are infectious in certain stages. We could give several instances that bear out this statement. The following two may suffice: In one of the Metropolitan Hospitals of India, a patient was admitted with a very bad form of dysentery. Three other patients, whose beds were close to his, were soon attacked with the disease in precisely the same form. In another case, a surgeon, performing a *post-mortem* examination on the body of a patient who died from a severe form of dysentery, suffered from the disease within twelve hours. This occurred in mid ocean, and in the absence of any other cause than the one stated.

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* The words "*specific poison*" here mean a definite agent, either a germ or other virus which, by its introduction into the system, is capable of producing the disease.

Various forms of *sore throat* are caused by the gases and particles of putrid organic matter and germs given off by fæces. Occasionally, in India (although more frequently in England and elsewhere), *diphtheria** is brought about from the same cause. But these are not the only influences of the foul emanations from human filth. If we are constantly surrounded by such accumulations, we are obliged to inhale the products of fæcal fermentation :† these, in their dilute form, bring about no sudden change in health, but they produce a subtle influence, far more dangerous because less felt : they bring about a lowering of the vital powers gradually, thereby rendering us less able to stand the effects of other disease causes. They often bring about headache, *indigestion*,* *debility*,† loss of appetite, and want of energy.

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* *Diphtheria* is a malignant disease of the throat, back of nose, pharynx, and often the larynx. It is characterised by the formation of a thick, greyish, leathery membrane on the parts affected. It is a most fatal disease, resulting from the introduction into the body of a specific poison. It is contagious, often epidemic, and in some places endemic. It is always accompanied by a very low state of the system, indicating the necessity of giving stimulating nourishment freely. Alcoholic stimulants are often required. Locally, antiseptic applications are used with a view of bringing about the destruction of the membrane and its contained germs.

† Fermentation is the spontaneous conversion of an organic substance into new compounds, by the influence of a ferment, these ferments being apparently vegetable organisms of extremely simple type, which, in their life, growth, and increase set up fermentation.

If we consider what must be the effects on children of the imperfect removal of refuse, we are forced to the conclusion that it tends to undermine their constitution and to lead to defective growth and development.‡ It often tends to cause an early death from some other disease, to which those brought up to greater degrees of cleanliness would not have succumbed.

Enough has been written to show that it is absolutely necessary to remove to a distance from dwellings all house refuse (human and other) as soon as possible. In a large proportion of the households of India, no provision for such regular removal is to be found. When questioned about it, the people tell us that this neglect has gone on for generations without evil effects. This freedom from evil effects, however, is imaginary. not real ; we could cite many cases where high sickness-rate and filth accumulations go on side by side. We should be up and doing in this matter. Every house-owner or tenant should deem it to be of the greatest importance to himself, his family, and his neighbours that the inside and outside of his house should not be polluted by filth collections. In many towns and cities, like those of Calcutta, Bombay, &c., we have Municipalities that do their utmost to reduce the evil effects of accumulated human filth. In villages. however, no such authority exists. In this case, the headman of the village should be held responsible for the regular removal of filth, and for the due precautions against nuisances arising from this cause around villages. But it must be remembered that a municipal body, or the headman of a village, cannot see to the cleanliness of the interior of individual houses; the inhabitants themselves must do this. In cases where people will not do it of their own free will, it becomes necessary to compel them to do it, to protect their neighbours' health.

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* Dyspepsia, or inability to digest, absorb, and assimilate the food.

† Weakness of body.

‡ Development is the process by which the different tissues and organs of the body are gradually fitted to fulfil their functions in the animal economy.

METHODS OF REMOVAL OF HUMAN EXCRETA.—We come now to consider the ways in which the waste matters of the bowels and kidneys might be removed. Speaking generally, these are divided into *Wet* and *Dry* methods.

Wet Method.—In India, except at or near the sea-coast (as Calcutta, Madras, or Bombay, &c.), the wet method of disposal of sewage is generally inapplicable. By this plan is meant a system which aims at the immediate removal of all house refuse, water, and human discharges, through underground pipes. The large or *main pipes* are laid along the principal streets or roads, and are joined by smaller or sub-main tubes, which run along the smaller streets and lanes, and these latter are brought into communication with every house by means of house pipes. No sooner is any liquid or material deposited in the house drain, sik. or privy, than it is instantly removed to a distance from the house by these underground tubes. The only matter left to be disposed of, then, is the *dry refuse*, such as ashes and manure, which is a comparatively simple undertaking.

Nearly all authorities on Sanitation agree with regard to the advantages of the *wet method*, if it can be carried out thoroughly. By it all matters liable to produce such diseases and other effects as we have enumerated are removed continuously, immediately, and completely. But to be carried out perfectly the wet method requires that (1) *water-closets* should exist in all houses, and that these closets can be regularly and thoroughly washed out after use, with a liberal quantity of water; (2) that the large volume of sewage produced by this system should be properly disposed of; and (3) that the house-connections with the sub-main sewers be of the highest order of workmanship.

The first and second of these factors are the most difficult to deal with, so much so, indeed, as to make sewage removal by underground pipes or sewers in inland India, with a few exceptions, almost impracticable. In Calcutta, Bombay, and a few other places, all these conditions, favourable to the removal by the wet method, are in existence.

It is now a recognised principle of hygiene that *pure* sewage should not be conveyed into rivers, for it renders the water altogether unwholesome. Authorities are agreed, however, that if the sewage be previously deprived of a large portion of its polluting agencies, there is not much harm in allowing the purified sewage liquid to flow into large rivers.

Several methods have been invented to carry out this purification of sewage, but the two most in favour are what are known as *Filtration* and *Irrigation*. Filtration is usually carried out by allowing the sewer-water to flow on to a small plot of ground, the soil of which is porous, this soil having been previously so prepared as to permit of rapid passage of the filtered sewage-liquid through it. The refuse sewer-water passes out by means of perforated drain-pipes laid six feet deep. Rapidly growing vegetables or grass may be cultivated in such soil. We are told by many authorities that the first few inches of soil contain vast crowds of little germs, which feed upon the foul bodies contained in the sewage that reaches the soil; by this means, much of the poisonous material is removed and the remaining liquid is less harmful. This liquid may then be allowed to run into rivers. " By *irrigation* is meant the passage of sewer-water over and through the soil, with the view of bringing it as speedily as possible under the influence of growing plants."

In most parts of India, for want of water or from the absence of a method suited to the permanent removal of, or from absence of natural facilities (as the contour of the ground), the removal of sewage by water cannot be adopted. Under any of these circumstances, one of two things arises—either the material accumulates around dwellings, or it has to be removed daily, or at a few days' interval, by means of carts.

Dry Method.—With the exception of the instances mentioned, the dry system (whenever a method is adopted) is that in general use in India. There are several varieties of the dry method, of which the chief are—

(1.) Cess-pool system.
(2.) Midden system.
(3.) Pail system.
(4.) Dry-earth system.

(1.) *Cess-pool system.*—This system is largely in use in India. It consists usually of an uncovered excavation in the ground in communication with what is called a latrine, by means of a *kucha* channel. The latrine consists of two stones or bricks on which the user sits. His excrement is deposited on the ground, and flows into the cess-pool or cess-pit. These cess-pits are fequently situated *in the public road*, and form the most offensive description of nuisance with which we are acquainted. This system is *never* admissible in towns, and we only name it to condemn it. Cess-pools may be permitted in solitary country-houses supplied with proper water-closets; but whenever they exist, they should always be situated at a good distance from the house, and should be regularly emptied. Further, they should be constructed of masonry or well burnt glazed brick, and lined with smooth hydraulic cement, and the communicating channel should be made of the same materials.

(2.) *Midden system.*—This is, perhaps, the best place to say a few words about the *sundass* or *midden-pit*. This disgusting convenience consists of excavation in the ground, which is covered over except at one place, over which people sit. The material deposited remains for months, and sometimes even years, without removal. In other cases, this pit is really a small chamber in the basement of the house, having a tiny door through which the scavenger is supposed to gain entrance. We have seen several cases in which the pressure of the material within these small chambers has burst open this entrance door, and caused the putrefying ordure to flow broadcast on to the public roads. In general, the disgusting condition of the interior of one of these closets, when the door is opened, is beyond description. The effect of the pent up and concentrated poisonous vapours from such places at times leads to serious and fatal diseases. It is very surprising to think that, living in a civilised country, at the present day, such evils should be allowed to continue

These pits are frequently seen side by side with wells. In such cases, if the wells be not very deep, and the sub-soil water is at a low level, there is often a direct flow into the well from the *sundass* or cess-pit; under these conditions the people drink a form of dilute sewage.

A *sundass* or cess-pit in a house is absolutely dangerous to the inhabitants, and in all cases they should be at once done away with and replaced by proper privies. This is one of the greatest sanitary improvements that could be effected in large towns and municipalities.

(3.) *Pail system.*—This method, in one or other of its various forms, is in general use throughout India. It implies really the use of a movable cess-pool, consisting of a pail or pan. The pail may be used alone, or it may be mixed with ashes and house-refuse, or some deodorant. As a rule, in India, the pail is used without any admixture with foreign material, and it is emptied daily. It is a somewhat offensive and laborious system, yet in the present stage of our experience we cannot offer any improvement on it.

A description of what is done in the large municipality of Chudderghat will enable us to understand the working of the pail system.

We employ a conservancy establishment consisting of peons, scavengers, and bullock-drivers. We have a certain number of iron, water-tight, night-soil carts, to convey the night-soil away from all public and private latrines situated within municipal limits. Each cart has a certain area allotted to it, with its driver, peon, and scavenger. These men are responsible for carrying out their work in the given area properly. In the case of *zenanas*, female scavengers are engaged to enter and clean out the privies.

The public latrines are placed in the most populous parts of the municipality, and consist of either corrugated iron or masonry sheds, with compartments. Each compartment has a recess into which an iron pan or bucket fits. This pan is emptied of its contents, morning and evening, into what we call the "intermediate" receptacle; these are elongated iron, cylindrical-shaped, utensils, having an air-tight iron cover. A sufficient number of these is attached to each privy to contain the contents of the pans, so that the latrines are always more or less clean. The night-soil is then conveyed to, and deposited in pits situated remote from all houses, wells, tanks, and water-courses.

In private houses we have advocated the construction of masonry privies, with compartments to contain pans, and, so far, we think that the people appreciate the cleanliness of this method, as compared with that of the *sundass* or cess-pool.

The pans, receptacles, carts, and latrines are regularly tarred; and a large quantity of disinfectants are used to prevent smell arising in the process of clearing the filth.

The plan above sketched, more or less modified, is that which is adopted in most of the inland towns of India. It is an exceedingly expensive and laborious one, but as we have remarked before, is that which appears in the present state of our knowledge to be the most efficient of the "dry" systems for a large Indian community.

To work such a system of removal as this in its perfected form, it is necessary to have a good conservancy staff, a sufficient number of carts and of public latrines, and a uniform description of private latrines. One public latrine of twelve seats is, perhaps, sufficient for 500 people, although more accommodation is advisable.

One great drawback is the want of co-operation on the part of the inhabitants. In some houses we find *sundasses;* in others cess-pools or midden-pits ; in others no form of latrine at all, the ordure being deposited directly on the ground. Were each house to have a properly constructed latrine with compartments and pans, our labour would be much decreased.

The plan of private privy we recommend is simple and inexpensive. It consists of a few compartments, into which iron pans fit. These compartments are surrounded, except in front, by *pucka* masonry, lined with smooth cement, which may be readily washed, if necessary. In front of the pans is a small superficial channel which leads to the public drain or to a cistern which is periodically cleansed.

Another modification of the pail system, and perhaps a less expensive one than the above, consists of deep circular pails, large enough to contain the ordure of six persons for a week. The people discharge the excrement into it directly. It is placed in a properly constructed cistern. The receptacle is removed weekly and replaced by a fresh one. Disinfectants are used to prevent any foul smells. This is a very convenient form of pail for private houses, but it *keeps decomposing human filth near the house.*

(4.) *Dry-earth system.*—This is a plan in which dry earth is used as a deodorant and disinfectant in the privy pans each time the privy is used. About one and-a-half pounds of earth are used on each occasion. This is the method that has found most favour with Europeans in India. It is clean and devoid of unpleasantness. It can only be used under favourable conditions, however, and one of these conditions is, that the matter to be dealt with is not considerable in amount. Dry earth is an excellent deodorant, and contains in itself germs which feed on the material with which it mixes. For private houses in the districts, or near villages, for regiments of troops, or jails, this plan works excellently, but for a large community it is impracticable. Why is it so? Because the earth is sometimes difficult to obtain in sufficient quantity, and if obtained cannot easily be kept dry, especially in the monsoons. The most important objection to it, however, in large populations in India, is, that *it has to be carted away with the ordure.* The removal of one and-a-half pounds of earth from Hyderabad and Chudderghat for each person daily, would mean about 5,625 maunds of earth to be removed daily in addition to the human filth. that is, about 200 additional cart-loads.

The question now arises whether, excluding the water-carriage system, there is any other dry method more suitable than the ones we have described. We think that, for large communities, there is not.

VILLAGE LATRINES.—In the case of villages, the people could scarcely do better than resort to allotted fields for the purposes of nature, and, as the fields become covered with ordure, they might be ploughed up and cultivated; or, they might use *trenches*, which should be placed to the leeward side of the village. These trenches should be about 20 feet long, 2 or 2½ feet deep, and 1½ feet wide. A part of the excavated earth is to be daily thrown into the trench, and when it is within a foot of the ground it should be filled up with the remaining earth and another pit dug. One is necessary for males and one for females, and each trench should be surrounded by bamboo matting. When an area of, say, one *bigah** has been used like this, it might be ploughed and used as a vegetable garden, or as a grazing plot, and after a year or so re-opened for latrine trenches.

UTILIZATION OF HUMAN REFUSE.—Human excrement s an excellent food for plants, and we should endeavour to assist Nature by placing on the soil what vegetation requires. Gardeners and village husbandmen in India are fully acquainted with this fact, but their prejudices prevent them from taking advantage of it. They take great pains to secure horse-itter and cow-dung, and all manner of house refuse for their *khets*, but this sort of material is only about one-third as rich in plant food as night-soil is. The Chinese (the thriftiest agriculturalists in the world) never waste a particle of organic matter that might nourish plants.

If the excrement of each person in any large town was valued at eight annas a year, and this were paid for it, a sum would be realised that should more than defray the expenses of its removal.

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* A *bigah* is equal to 3,600 square yards.

In some municipalities of India, the night-soil is prepared for the cultivator by digging shallow trenches, into which the ordure is deposited, and then mixing the ashes of houses with it, drying and pounding it, finally selling the product as "*poudrette*" *manure.*[*] This produces good crops, and is able to convert barren into fertile soil. The money thus realised pays a large share of the expenses incurred in the removal of the night-soil. It should be known that in the drying process above alluded to, much of what is the best food for plants (particularly the ammonia) is *volatilised.* The pure, fresh night-soil is the best for this purpose, and when we discover some cheap and yet efficient way of getting rid of its bad smell, it may be used for the purpose more extensively in India. As we have said before, the surface of the soil contains minute germs[†] that decompose the excrement of human beings, and thereby render it fit for food for plants. It may be said that no known system of preparation of sewage has as yet led to a profit. But we do not require profit; we want to secure safety from disease, and keep ourselves in health. This comes first; profit is of secondary consideration.

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[*] *Manures* are animal or vegetable (and sometimes mineral) substances introduced to the soil to accelerate vegetation and increase the production of crops—substances used to improve the natural soil or to restore to it the fertility which is diminished by the crops annually carried away.

[†] Microscopic vegetable organisms, chiefly bacteria.

Final Disposal of Human Excrement.—The night-soil from towns and municipalities is usually conveyed away to some waste-land situated remote from houses, or it is deposited in trenches. With regard to these trenches, we would state that the shallower they are the better, for ultimate decomposition of human ordure goes on but slowly deep in the earth. The usual trench is about 50 feet long, 2 feet wide, 3 feet in depth. Even this depth is too great, and if enough land can be got, the night-soil should not be deposited at a greater depth than 2 feet. We would strongly recommend the cultivation of such land after a sufficient area has been covered with trenches, and filled up with excrement coated with earth.

Public Latrines.—With regard to public latrines, these may be any one of the many patent metal latrines (such as Hawbury's, Richardson and Cruddas', either of which is simple, cleanly, and efficient), or they may be constructed of masonry or well burnt brick. This latter is the worst material for use, except the common sun-dried bricks. In all cases the foundation should be good, and the surface of the basement smooth, so as to be easily washed. The latrines themselves should be placed at a distance from houses, or where they will not be a nuisance, and yet be convenient for use.

Private Latrines.—In towns and municipalities where the water-carriage system is not in use, the private latrines may be constructed of masonry or bricks; but whatever is used, it should rest on a good layer of cement, and be covered by a smooth coating of the same material. A good form of private privy is one consisting of small masonry pillars, leaving spaces, which spaces (circular or oblong in shape) are to contain the pans. The privy should be built *outside* the house itself, but within the enclosed compound wall. All compartments of the privy should be furnished with a metal pan having the same shape as the compartment. In large houses with many occupants, it will be necessary to have these pans cleaned out twice a day, a large cylindrical receptacle, with an air-tight lid, being used to contain the collected material. This larger utensil is then ready to be emptied of its contents on the arrival of the night-soil cart.

We do not advocate the construction of private latrines in densely crowded places. The lower class people, at least, in such localities should, whenever possible, resort to the public latrines. Human ordure in compounds, even under the most perfect system of conservancy, is an abiding evil. In isolated houses the *dry-earth system* is the best that can be adopted in India.

DIFFICULTIES OF REMOVAL OF HUMAN ORDURE FROM GOSHA LATRINES.—Under any system of conservancy, except the water-carriage one, it is difficult to keep *gosha* or *zenana* latrines in a satisfactory state. In the first place, the night-soil carts can only visit these places once or at most twice a day; further, the circulation of each cart is limited to certain hours, so as not to be a public nuisance. From the great privacy of many *zenanas*, the female scavengers have not that ready access to the privies that is necessary to remove the accumulated excrement. If the woman cannot enter the compound at once, she is obliged to go on to the next. We mention this from an experience of the difficulties we have had in such matters, and we look on this as one of the greatest obstructions we encounter in the working of our conservancy department.

Municipal sanitary authorities cannot undertake o look after the cleanliness of the latrine of every house. This, in private dwellings, becomes a personal matter to the occupants ; each person *must* look after he state of his own privy, and keep it in such a ondition as to be neither a nuisance nor injurious to his own or his neighbour's health.

The following example came under our own observation, and will show how much may be done by ndividual action in sanitary matters. A village in Burmah, situated close to a military fort, was in a ery filthy state ; the ordure and rubbish of years had accumulated around it. The troops occupying he fort, and the villagers, were constantly sick. We ordered the headman (or *thoojee*) of the village o get every person to clean up his house and remove ll the filth, rubbish, and decaying vegetation from he precincts of the village. They did so. Disease apidly declined, and eventually disappeared, for the eople were then compelled to maintain their houses n a proper sanitary condition. Caste prejudices in ndia preclude this, but the principle is what we efer to. It may be stated that in every town or city where a proper system of removal of human filth (whether wet or dry, but especially in the former) has replaced the barbarous cess-pits, middens, or *sundasses*, the sickness and death-rate have been largely reduced.

CHAPTER VII.

DRY REFUSE AND ITS REMOVAL.

DRY refuse consists chiefly of garbage, the peelings and unused parts of vegetables and fruits, ashes, house and street sweepings, and the droppings of horses, cows, and other animals. This refuse contains a considerable amount of organic matter which rapidly decomposes, and in doing so gives off foul gases. The same may be said of decaying vegetation in gardens and houses. This takes place much more rapidly in the presence of water. It is very necessary, therefore, that it be kept *dry*; no refuse water of houses or slops are to be mixed with it. Further, it is necessary to remove this material periodically, but we require some system to work on, in order that we may efficiently remove the dry refuse from all parts of a town. The following plan is recommended :—

Every house should have an earthenware, wicker-work, or metal utensil, with a water-tight lid, large enough to contain all the refuse of the day. This is to be emptied daily into large *dust-bins* that are to be provided by the local sanitary authorities. This dust-bin is usually a corrugated iron receptacle of cylindrical or cubical shape. It should have a *water-tight cover*, and be large enough to contain one day's refuse of the area for which it is intended. Rubbish carts should come round daily and convey away the dry refuse from these receptacles. The carts should remove the dry refuse to a distance from houses, and place it so as to form heaps, which might later on be used as manure. This material might then be sold. In depositing it we should be careful that the direction of the wind is considered. This plan is simple, efficient, and cleanly ; it is done in a large number of towns and municipalities in India. If this method cannot be effected, the rubbish may be collected in central depôts and burnt, and the ashes sold as manure. Dry refuse may be made use of to fill up excavations in the ground *outside* the municipal limits ; it should never be used to fill up old wells or hollows *inside* the municipality, nor should it serve for filling in the foundations of houses. In all cases, the filling-in process must be carried out rapidly, and the last two feet must be filled with dry-earth or moorum.

The dust-bins are usually placed so close to the house that there is no labour in throwing the house-sweepings and other forms of dry refuse into it at once. If we have a garden and a big compound, we may throw the dry refuse on the soil as manure. We should remove from our compound any jungle, *shrubs*, and fallen leaves that are about : all these might be burnt at once.

The dust-bins should be placed so as not to be a nuisance to others, and people should find out where the dust-bin of their neighbourhood is situated and use it when necessary. In the absence of a receptacle in houses, a basket would do, care being taken to keep the contents dry during the monsoons.

CHAPTER VIII.

DRAINS AND DRAINAGE.

Surface drains—Final disposal of drainage liquids—Disposal of dead animals.

IN the large towns and municipalities in which underground sewers or drainage pipes are laid, all the slops from houses, from stables, factories, slaughter-houses, the waste water of wells or other water-supply, together with all human ordure and urine, gain access to the sewers. When this, the *water-carriage method*, is practicable, it is by far the best that can be adopted, but as we have mentioned before sewers require a lot of water to prevent the foul, solid matters sticking to them, and there must be a means of finally disposing of the large volumes of sewage that flow in them. The great advantage of this system is that it at once removes all the filth from around dwellings.

In cities, towns, and villages, where such sewers do not exist, some provision must be made for removal of all surface liquids, otherwise the foul waste waters are thrown on the ground, soak in, and thereby pollute the soil, the air, and eventually the water of wells. In the absence of sewers, slops and all kinds of refuse liquids must be conveyed away in open channels called *surface drains*.

SURFACE DRAINS.—We have learnt that refuse house liquid pollutes well water. The want of a proper drainage system is one of the defective points in the sanitation of Indian villages and towns. What one usually sees is an irregular *kucha nullah* or channel, excavated without any reference to the natural line of drainage. So long as the refuse liquids are carried away from the immediate surroundings of the house, the people appear satisfied. The waste waters finding their way into such channels, do exactly that which they are intended to avert. The liquid sinks at once into the earth, and the heat of the sun soon causes foul emanations to arise around the house. In all cases the entire system of drainage of a town ought to be carried out on a definite basis. To effect this, levels showing the natural fall of the ground should be ascertained; the main drains should be laid along the large streets and sub-mains in lanes. All private house-owners or tenants should construct house-drains communicating with these main and sub-main drains. Into the house-drains all refuse house water should be thrown, so that no foul water may accumulate in or around the house. All such drains should be constructed of masonry. They should have a good, thick foundation of cement, and they should be lined with a smooth layer of the same material. If this system is carried out properly, all the waste water of the entire place is conveyed away at once.

FINAL DISPOSAL OF DRAINAGE LIQUIDS.—The question now arises—What is to become of this waste water? It should be conveyed to some distant place into some large ravine or hollow, remote from habitations, or on to some cultivated fields. If possible, it should not be allowed to run into rivers without filtering through the soil to partially purify it.

In large isolated houses with gardens, the slops may be conveyed in properly laid pipes into the garden. These pipes should be thoroughly jointed up to the point at which they reach the garden. In the garden itself, perforated tile pipes may be used, which are to be placed underground. so that the water infiltrates the soil thoroughly.

In towns and villages where drains are not laid, the people should throw all refuse liquids into channels communicating with cisterns in the house compound, which cisterns are to be periodically emptied. Cisterns, however, are always unsatisfactory; they cannot be cleaned out properly, and the result is that the slops (rich in putrefying organic matter) overflow, permeate the soil, gradually get to the foundation,* and finally, rising in the walls, render the house damp, and give off foul odours within the house. This must always be considered but a temporary measure: if sewers are not or cannot be laid, surface drains are inevitable.

The form of cistern best suited to a house is one of semi-ovoid shape, built of masonry, the stone being laid in a thick layer of cement and lined with a layer of the same material, so as to be smooth inside and present no irregularities to which solid matters may cling. If a garden be attached to the house the cistern water may be thrown into it daily.

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* The *foundation* is that part of a building which is underground, on which the walls, &c., rest. Foundations are usually made by providing a hard, impermeable base for the masonry or brickwork, by methods which vary according to the position and nature of the soil.

Disposal of Dead Animals.—As soon as an animal dies, arrangements should be made for its immediate removal from the village, town, or municipal limits. This removal should always be effected before decay of the carcase commences. Municipal peons or policemen should, on their rounds, be on the look-out for dead dogs, cats, rats, &c., and have them immediately conveyed from the municipality or town. If the animal dies from an infectious or contagious disease, it should be covered with a layer of lime, and at once carted or carried out of the municipal limits and buried deep in the soil, away from all water-sources. Dead animals of any description should not be thrown into dust-bins or mixed with the dry refuse.

CHAPTER IX.

THE HOUSE AND ITS SURROUNDINGS.

Site—House Sanitation—Dhers and Wadders—Camp and Jungle Life—Public Health Regulations or Sanitary Legislation—Municipalities—Municipal taxation—Vital Statistics—Public and Pauper Hospitals—Use of Patent Medicines—Sale of Poisonous Drugs—Disinfectants.

THERE are very few houses or huts constructed as they ought to be. Well-to-do people, before building an expensive house, should get the opinion of a good engineer as to its plan. Poor people have no choice as to the house they occupy, or they are obliged to make it of the cheapest possible material. But every one should have an idea as to what constitutes a healthy house, and they should know something regarding the factors that contribute to its healthiness. These are chiefly *the site* and *surroundings*.

SITE.—All low-lying and hollow grounds should be avoided. Into these the water of the higher ground drains and collects, making the place damp and unhealthy, especially in the monsoons. The result is that the people occupying such houses are constantly suffering from chills and fever. This fever comes mostly when the sun is drying up the ground, for at that time the decaying vegetation gives rise to gases or germs that create disease. These gases or germs are the potent causes of " malarial " fever.

We should secure the highest available site for our house, if it be otherwise suitable. We should live as remote as possible from *jheels*, marshes, and swamps, and avoid, as far as possible, the margins of rivers and tanks, that is, at least, 200 yards away from them.

If it is absolutely neccssary to build on such places, they should be previously prepared by *deep* drainage and cultivation. If a marsh exists to the windward side of a house or village, the bad effects of the malarial air may be to some extent prevented by planting a belt of trees between the marsh and the house.

The most suitable soil to build on is one of a gravelly or *porous* nature. Avoid *clay soils*, as they are damp and give rise to rheumatism, chills, and fever. The ground around should not be contaminated in any way. Decaying vegetation causes malarial fever; therefore, avoid ground that contains organic vegetable matter. Sloping ground is good for a building site, if the drainage of the higher parts be diverted.

In the case of rich people, who can afford to pay engineers for a good plan of a house, we cannot profess to point out the requirements; but for the houses or huts of the poor, we would lay down a few general rules. Their huts should be built after a good model. Say, a dwelling-place for a family of five people is required. It is necessary to have two rooms at least, with a third forming the kitchen and cook-room. These two rooms may be small (twelve feet by fifteen), as may also be the kitchen (six feet by ten). They should be about twelve feet high. At the back of the house there should be a small yard enclosed by a wall. The yard should contain the house latrine, which should be free of access from behind for the purpose of facilitating the removal of all excreta. The house should, in all cases, have a good foundation, and a basement raised not less than a foot from the ground, and, if possible, the basement wall immediately above the level of the ground should be covered with a layer of impermeable cement. Each room should be provided with two opposite windows, about a yard square each, which should open directly nto the air. Each room should also have a door. n every case where possible, the house or hut should be surrounded by a verandah; or if this be placed on one side only, it should be on that side where the sun shines most.

The chief winds blow north-east and south-west. The long axis of the house should then be north and south, so as to meet the wind obliquely. The *bedroom* should be thoroughly ventilated, and should be as free as possible from all furniture. Never keep food and dirty pots and pans or dishes in it; the food gets spoiled by the air, and if the food itself is decomposing, it pollutes the air. No fires should be made nside the house, unless there is a proper chimney to ake away the smoke, as the smoke makes the air mpure. A properly constructed inside chimney helps largely to cause the air to circulate through the oom, whether a fire is burning or not. When no ire is burning, the wind sweeping over the top of the chimney creates a vacuum which draws up the air from the room. Never burn charcoal in a room in which you are to sleep. Charcoal in burning gives out a gas called *carbon monoxide*,* which, if inhaled in sufficient quantity, kills like opium. In France and other countries, many people die from this cause.

House Sanitation.—A house should not be surrounded by too many trees. A few are good, for they serve to keep the soil and foundation dry, by sucking up the moisture; they further keep the house cool, and afford a grateful shade. No jungle or shrubs should be allowed in or around house compounds. Fallen leaves should be collected and burnt. No animals should occupy houses used as abodes for human beings. One often sees *syces* living in stables, and cows and gowlies living under a common roof. These animals make the air very impure. Further, their droppings give off odours and gases of an unpleasant nature. The droppings eventually dry up and crumble to powder, the particles being directly inhaled. If such animals are kept, all the refuse matter (droppings, urine, and other filth) created should be removed daily. The manure so collected may be stored up in heaps, but such heaps should be at a distance of at least 100 yards from all human dwellings. It may then be sold as manure, or manufactured into fuel cakes.*

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* *Carbon Monoxide*, or *carbonic oxide*, is a body obtained pure by passing carbonic acid gas through iron tubes over red-hot fragments of charcoal. It is a colourless, inodourous gas, and burns with a pale lavender flame. It is very poisonous.

The floor of such huts should be coated with clay every week. This is much better than cow-dung for the reason above given. A mat might be provided without much cost.

The house should be *lime-washed*† twice a year, both inside and out. This acts as a mild disinfectant. By whitewashing *outside*, we help to keep our houses cool in the warm weather, as the heat is reflected, or sent back, to the air.

You should have your rooms and verandah swept regularly once a day. Do not wash the floor, for this creates dampness, which causes chills and fever.

The *privy* attached to the house should be kept in a state of perfect cleanliness, and this can only be done by the daily removal of accumulated material, and by washing the ground and pans attached to it.

The house-drains should be made *pucka* and communicate with the public drains. They should be kept clean by pouring enough water into them every day. Cess-pools and *sundasses* should be forbidden.

The well in a compound should be kept from every source of pollution. Cess-pools and *sundasses* are particularly liable to affect the quality of drinking water. The water of the well may be supplied through a stratum of the ground which carries the ooze from a cess-pool or *sundass*. The effects of this are not felt so long as the water is high in the well for the pressure of the well water drives back th sub-soil water; when the level of water in the wel is low however, the well may be directly supplie through this ooze.

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* Or *Bratties.*

† *Lime-water* is prepared by mixing ordinary lime (oxide of calcium) with water in proper proportion.

Every house should be separate from the adjacen houses, so as to permit of free ventilation and preven density of houses and over-crowding of people. Al *streets* and *roads* should be straight and broad, and al old and dilapidated houses and disintegrating wall blocking up lines of roads should be knocked down they prevent free circulation of air around houses and are often used for committing *nuisances* in.

In all large municipalities and towns there shoul be open spaces of ground here and there in whic gardens should be cultivated; these might be used a recreation grounds by the people. Any such space in existence should be preserved, and no one allowe to build on them. All ditches and pools near house should be filled up with earth. Pits are frequentl created by people removing the earth for buildin purposes. When they excavate the ground to a certain level, the sub-soil water flows into the pit. Thi is the origin of a large number of the superficia wells in many villages and towns. The water fro such wells is very impure.

These pits, if not formed into wells, are used fo committing nuisances in, or for throwing rubbish int which rubbish during the rains mixes with the rain water and makes the place very unhealthy. All suc excavations should be filled up with earth.

All houses should have arrangements for carrying off the rain-water from roofs into the house-drains.

DHERS AND WADDERS.—These are people who frequently arrive and erect sheds on the confines of villages and make these their abode for a varying time. They are very foul in their habits, and permit filth to surround them without making any attempt to remove it.

They should never be allowed to place their sheds in the precincts of the municipality; but may, of course, live in the town or village like other people, if they keep their houses and surroundings clean, and do nothing to interfere with the general health.

If we have to choose a house in a town or village, we should try to get one in a wide street, where the adjacent houses are not too high, with a proper number of windows and doors, and proper drains and latrine arrangements.

The subject of house sanitation forms one of the most important subjects with which we can deal. We should always keep our houses free from the sanitary evils already described. If a house is defective in construction and general arrangement, it will, in the end, cost us much more than a house that is a little more expensive in its original construction.

We have already mentioned the case of a dirty village in Burma, near a fort, which created dysentery and fever. All the people of the village were made to clean up their houses and surroundings, and these diseases disappeared. In looking after the sanitary state of our houses, a very small amount of attention daily suffices. This attention must b regular and systematic, and each person must conside himself personally responsible for the cleanliness o his own house and compound. We should remembe that a filthy house may be the starting point of a disease that may spread throughout the community

People frequently grumble at the landlord of thei house for not carrying out such fresh sanitary improvements as may be required; this is certainly ofte a grievance. But we should remember that it is no the landlord who suffers from the defects in existence We must do all we can to help ourselves. *It is neve a necessity to live in a filthy, dingy house, wit unwholesome surroundings;* a little personal labour and the laying out of a very small amount of money is frequently all that is necessary to make an apparently unhealthy house habitable. One main necessity is to get rid of *dirt*, no matter where it exists i our houses; we should detest it in any form and neve cover it up. We should *love to be clean*, and *not* only to *appear* so. The sanitary defects of the averag house and hut in India are due to ignorance an carelessness in the original construction and arrangement of the dwellings, which evils are further adde to by the foul habits of the people. In these tw directions, then,—house construction and change o habits,—sanitary reform is most urgently needed.

CAMP AND JUNGLE LIFE.—It often occurs in Indi that people are obliged to adopt a camp life durin certain parts of the year. This is particularly so i certain departments—Revenue, Survey, &c. If w are to be any length of time in tents, we should make ourselves as comfortable as possible. It is very advisable to take every precaution, especially in winter, against catching colds and chills. The best way to do this is to take with us a sufficient quantity of warm clothes and bedding. With regard to bedding, it should be remembered that it is as necessary to have as much beneath as above when sleeping. Be careful as to the places where tents are to be pitched; avoid hollow ground, or ground in which there is decaying vegetable matter, or that is damp.

We should always have some sort of bedstead, so as to sleep off the ground. If this be not possible, we may sleep on straw or well-dried grass.

In camp it is as necessary for us to attend to the sanitation of our tents and their surroundings as it is in the case of houses and huts in towns and villages.

Whenever possible, we should take a few important medicines with us, in case they may be needed, especially *quinine*, *chlorodyne*, and *ipecacuanha*.

PUBLIC HEALTH REGULATIONS OR SANITARY LEGISLATION.—We have been taught by experience, that sanitary regulations are necessary to guard the health of the individual and that of the public. Such sanitary rules, when sanctioned by the head authorities in a State or Government, become part of the law of the land. To do anything forbidden in such laws renders the offender liable to punishment. Ignorance of these laws forms no excuse for him. If a man commits a theft and is charged with it, he is punished. In the same way, if a man commits any nuisance, or does anything that is liable to be injurious to the health of his neighbours, he should be punished. Those who are directed to draw up sanitary rules for the people, make every allowance for local requirements and peculiarities. In some cases the enforcement of a sanitary law may be deemed a hardship, but we should consider that the object is to benefit the masses of the people. A trifling nuisance in a single instance may not be dangerous but if every member of a community committed such a nuisance we should have a very great evil to contend with. The laws aim specially at protecting the people as a whole and not the individual. Sanitary laws provide for maintaining *water sources** free from pollution, our streets and lanes and private latrines, compounds, and houses clean; they aim at preventing the spread of contagious and infectious diseases. If we take the trouble to read the rules published by any municipality in India, we shall find that they are both just and necessary. A strict obedience to them will serve to remove that utter selfishness that has for a long time prevailed amongst house and hut owners. Such persons will see that they are compelled to keep their premises in a sanitary condition. They will recognise that dirty houses and surroundings are dangerous to their own and their neighbours' health. It behoves every one to obey these rules, and this obedience should be a matter of pleasure, and not prompted merely by the fear of punishment.

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* The main water sources are—rivers, streams, wells, tanks, lakes, and artificial reservoirs.

MUNICIPALITIES.—A Municipal Corporation is a body of educated persons, chosen either by the Government or by the people (usually a certain number by both) to protect the public health and enforce sanitary laws in the area situated within the municipal limits. The municipal body are also expected to effect such sanitary reforms as are likely to preserve the people from disease. The municipal is the oldest system of sanitation, and it is particularly well suited to India. It dates back from the time when the Aryan Hindus crossed the Indus, over 2,000 years ago. In those days, however, the stringent measures now adopted in the hygiene of towns were not so necessary, for the people generally lived in small communities and led simple lives. It differs very much when we have to deal with, say, 300,000 persons packed together in one town. Further, it is now well-known that the march of civilisation conveys its train of sanitary evils, which it is our duty to try and counteract.

Most large municipalities are now marked out into divisions, and over each division one of the members of the Municipal Committee, called a *Municipal Commissioner*, is appointed. We should find out who is the member for the division we occupy, in order that we may represent any nuisances arising in the vicinity of our house.

MUNICIPAL TAXATION.—State taxation is money paid by the subjects of a sovereign, for which they obtain security of life and property. But in addition to this there is another form of taxation, called municipal taxation. By this is to be understood, the payment of a certain small sum of money by the inhabitants of a municipality, in return for the great number of benefits that are conferred on them by the guardians of the public health—the Municipal Commissioners. A tax for this purpose may be directly imposed upon persons occupying holdings within the municipal limits, according to their means and property, upon the annual value of property, which is called the *house-rate*; on carriages, horses, &c., which is called *wheel, carriage, or horse-tax*; for pure water supplied, &c.

Many people think that such taxation is unjust and that very little benefit is conferred on them in exchange for the taxes paid to the municipality. Let us enumerate a few of the items attended to by them, and then we may judge for ourselves in the matter:—

(1.) The Municipal Commissioners see that the water used from wells and tanks is not contaminated: they build parapet walls around and periodically clean out and deepen wells. They prevent the people from fouling the water. In many towns they have provided public water works, by means of which the water is conveyed to the doors of the people.

(2.) They light up our streets at night.

(3.) They provide public latrines, and daily or periodically remove the contents, both from these and from private privies.

(4.) They provide sewers, or lay main and sub-main drains, to remove all the refuse water from our houses.

(5.) They keep the roads and lanes in a state of repair, and have them regularly swept, so that the dried up particles of dirt may not injure our lungs, eyes, and clothes. They cart away the dry refuse collected from road sweepings and from houses, and they water our roads.

(6.) They see that the vendors of food do not expose for sale any vegetables, food, meat, bread, rice, *dhall*, *atta*, or other kinds of food that are unwholesome, and if such food is exposed, they take steps to have the vendors punished.

(7.) In times of epidemic diseases, they provide us with hospitals to be treated in, or, if necessary, send medicines to our houses.

(8.) They prevent our neighbours from doing anything that is likely to be injurious to health.

There are many other points attended to by Municipal Committees, but these are enough to show that our welfare is looked after to no small extent by them.

It is unfair that a Government should defray the expenses incurred in these different ways. To our mind, the granting of money by Governments for such purposes is like giving alms. We should not like to roam about the streets asking for money and food; nor should we like to go to our neighbours and say, " We came to beg for money to pay for the laying of a house drain," or " for the payment of the monthly salary of a scavenger."

It is necessary and unavoidable that we contribute our share, no matter how small it be, towards defraying the expenses incurred in keeping our surroundings in a sanitary state, to preserve our health, and protect us from disease. Remember that no one receives any profit out of municipal funds. The tax-payers themselves are the only gainers. Whatever is carried out by Municipal Corporations is for our good. When such matters as we have referred to are under the guidance and supervision of an educated body of well-chosen men, they are carried out more uniformly and economically than could be done by private individuals collectively. The members of the Municipal Committee are so chosen or appointed as to be representatives of the main classes of the community.

Vital statistics.—Vital statistics is a branch of sanitary science, which deals with the application of figures to human life. Their object is to show us what degree of healthiness or unhealthiness prevails in the country, and in different parts of it, in towns and in the several division of towns, and in villages. They point out at a glance what part of a town is most unhealthy, and thereby direct our efforts to insanitary places. Vital statistics are most useful to sanitary officers, for by such figures they can tell at once the actual state of health of a place. Further, by such statistics, we are enabled to tell to what extent vaccination prevents small-pox, and to what extent epidemics of special diseases are fatal. In preparing such statistics there are many points taken into account. The chief are (1) the annual mortality, that is, the deaths in a year out of a certain number of the population, which number is usually taken as 1,000; (2) the annual rate of increase or decrease of the population, that is, the excess or diminution of births over deaths; (3) the actual causes of death; (4) the relative amount of sickness to the population; (5) the number of births per 1,000 per annum; and (6) the relative number of *live* to *still-births.* These and other points of great value, but of less popular interest, are brought out by properly prepared vital statistics.

In nearly all municipalities now, we have laws imposing on inhabitants the necessity of registering every birth within a certain period after its occurrence. The registering office may be a police-station or the court-house, or some specially appointed place in the municipality. The same holds good with deaths. A death must be reported invariably within 48 hours of its occurrence. This report should give the name, age, and sex of the person deceased, and the name of disease that caused death; this latter should be, if possible, certified by a medical man. This practice would be a great safeguard against homicide* in its various forms.

PUBLIC AND PAUPER HOSPITALS.—In every civilised country there are hospitals for the treatment of the poorer classes, or for those who cannot afford to call in a doctor to treat them at their homes. Such hospitals are kept up either at the expense of the State Treasury, or by private donations and contributions.

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* *Homicide* is the killing of one man, or human being, by another.

Sometimes both methods are combined to defray the expenses of these institutions. Government educate men to serve in these hospitals as doctors. At each hospital a proper establishment is kept to look after the sick, and medicines of the best kind are supplied. All persons coming for treatment get every attention shown them and are treated free of charge. This is a very benevolent custom. The Government have now established dispensaries and hospitals in almost all parts of India, which are in charge of medical men thoroughly qualified to carry out the work entrusted to them. A large amount of work is done in these dispensaries and hospitals. Amongst certain castes of Hindus and others, there appears to be a great dislike to coming to public hospitals for treatment; they think that by so doing their chances of getting better are lessened. The contrary is the case. In all serious cases of illness in the houses of the poor, the patient *cannot* get in his home the attention he requires. As a rule, he is living in an insanitary house, with a deficiency of air (and even that air foul), and receiving much less care than he would in a hospital; in short, he is in a state of poverty with all its evils and miseries. Yet he prefers this squalor, wretchedness, and affliction, to going to a hospital, specially constructed for the care of the sick poor,—a hospital with a good establishment, good food, and good medicines. When his disease assumes a fatal form, he frequently, as a last resource, comes to hospital. At this period medicines are of little avail. Doctors are as incapable of dispelling fatal diseases by charms as other people are. Failing to go to the hospital, the unfortunate pauper interviews a quack, *kobaraj*, or *pausari*, who frequently gives some powerful medicine that does more harm than good. These quacks know nothing about the scientific treatment of disease. How can they? They have had no special education or training in it.

A poor man, therefore, should always go to the public hospital or dispensary in his town, village, or *bustee* if he feels unwell. By doing so, he gives himself every chance of being able to return to his work soon. He should never allow the disease to remain until there is no hope of its being cured.

We must remember that such hospitals are only intended for the treatment of the poorer classes; wealthy people, in taking advantage of them, carry out a species of fraud. This does not, of course, refer to emergencies, but to ordinary every-day practice. The well-to-do should send for a doctor to treat them in their own houses. In all cases we should do whatever the doctor tells us, otherwise we decrease the chances of our rapid recovery. We should go to one doctor and have no other. We should not allow meddlesome people to interfere with our doctor's advice or treatment; nor should we be constantly changing our treatment. Never go to *kobarajs*, quacks, or charlatans, and never rely on those who profess to be able to dispel disease by charms or by the casting out of evil spirits.

USE OF PATENT MEDICINES.—Many people are constantly using *patent medicines* in the most indiscriminate way. This is a very bad habit. The composition of patent medicines is usually kept secret, and we should never take any drug if we do not know of what it consists.

Some persons, even when well, are constantly dosing themselves with medicines of some kind, especially aperient pills or "opening" medicines. They eventually disturb their inside to such an extent, that in the absence of some powerful purgatives the normal function is not carried out. When cholera is about, the use of purgatives is really dangerous, unless prescribed by a doctor. It is wrong in principle to take medicines if you are in health, and the only exception to this is in case you live or work in a malarious district, where the habitual use of small doses of *quinine* prevents ague and its allies.

Except for simple complaints, you should not use medicines without consulting a doctor. If you are obliged to prescribe for yourself, never take anything but the simplest remedies. Never take a powerful or poisonous drug, unless it has been specially ordered by a physician.

SALE OF POISONOUS DRUGS.—We might here mention that bazaar medicine vendors, or *pausaries*, are, throughout a great part of India, allowed to sell poisonous medicines to any one wishing to purchase them. Yearly, a large number of fatal cases of poisoning arises from this cause. Opium,* arsenic,† nux vomica,* preparations of mercury, and other powerful medicines can all be purchased in large quantities. Almost weekly we see cases of mercurial poisoning from the ignorant use of *rus-kapoor.*† In England such poisonous drugs are not allowed to be sold unless prescribed by a physician, and their sale should be prevented in this country also.

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* *Opium* is the dried juice of the poppy, grown abundantly in India.

† *White arsenic or sunkya* is that sold in the bazaars.

DISINFECTANTS.—A disinfectant is an agent that is capable of *destroying* putrid or decomposing organic matter, and of preventing the action of germs causing disease, or destroying the vitality of such germs. *Deodorants* are substances that remove foul smells. Some of these, as charcoal, by *oxidising* the body causing the smell, are both deodorants and disinfectants. Others, as tobacco and camphor, *merely hide smells. Antiseptics* are bodies which prevent putrefaction.

Some kind of disinfectant should be kept in every household; yet its use should not interfere with an abundant supply of *fresh air;* nor does its presence remove the necessity of *cleanliness* in its widest meaning.

The most useful disinfectants in India are—*Heat, Sulphurous Acid, Carbolic Acid, Phenyle, MacDougal's Powder, Calvert's Carbolic Powder, Sulphate of Iron, Sanitas, Charcoal,* Lime, Chloride of Lime, and Chloride of Zinc.

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* *Nux vomica* is the seed which yields strychnine.

† A very impure compound of mercury is freely used by the people of India as a medicine. It is known as *rus-kapoor,* and consists of a mixture of corrosive sublimate and calomel. This is highly dangerous to use.

Heat as a disinfectant may be dry or moist. *Dry heat*, as a rule (except that of the sun), is only practically useful when the things to be disinfected are small in bulk. This form of disinfection may be carried out in a sort of baker's oven, having wooden cross-bars on which to hang the articles requiring purification. *Moist heat* as a disinfectant is chiefly useful in disinfecting soiled clothes of patients suffering from cholera or infectious diseases. The clothes may be steeped in the boiling water. Articles of furniture may also be purified to a certain extent, by pouring boiling water upon them.

Sulphurous Acid for disinfecting purposes is generated by burning sulphur on live coals. It is chiefly useful for fumigating rooms that have been rendered infectious by small-pox and cholera patients. Large quantities of sulphur are to be used—a pound at least for every 1,000 cubic feet of air space; and before commencing the burning process, all the doors, windows, chimneys, chinks, or other apertures communicating with the outside air, should be closed. After the sulphur fires within have become extinguished, the doors and windows should be opened, and currents of air allowed to pass through them for six hours.

Carbolic Acid is a valuable disinfectant, but it is poisonous. It is commonly used mixed with some simple coloured powder, in which form it is much safer. Such powders are found in MacDougal's powder and Calvert's carbolic powder. For the disinfection of drains, privies, and bath-rooms, a solution of carbolic acid is much more effective than the carbolic powders. The solution should not be less than one part of acid to 50 of water, and in this form it may be sprinkled about the room, or the floors of a sick chamber may be washed with it. In case of infectious disease, the sick may be screened off from the healthy by a sheet, saturated with the carbolic solution, hung outside the door. All infected linen from the sick patient should be steeped in such a solution, before being removed from the room. For this latter purpose carbolic acid solution is particularly useful.

Phenyle is a very convenient preparation for these purposes.

Sulphate of Iron is a cheap, although a weak, disinfectant. It can always be got in the bazaars. It cannot be used for disinfecting clothes, for it would iron-mould them. Its use is limited to drains, cess-pools, *sundasses*, and rubbish heaps, for all of which it is very satisfactory in a state of solution.

Charcoal is a disinfectant as well as a deodoriser. It contains in its meshes eighteen times its volume of oxygen, which is capable of oxidising any organic matter with which it is brought into contact. If the air of a room is impure, and no proper ventilating arrangements are available, charcoal, suspended in open network baskets, is a simple and useful purifier; it is also useful in purifying cess-pools and filthy cisterns.

Lime.—Ordinary Lime is a cheap agent with feeble disinfectant properties. A layer of it laid in offensive drains of filthy accumulations, removes foul smells.

Chloride of Lime Solution is a powerful disinfectant, and may be used to disinfect clothes and furniture, and the walls of rooms.

Chloride of Zinc is likewise a powerful disinfectant, and may be used in much the same way as the chloride of lime.

Every house should contain some disinfectant. Cheap disinfectants of some kind are always procurable in the bazaars. In cases of necessity, the houses of the poor can, in most municipalities, be supplied with disinfectants.

CHAPTER X.

INFLUENCE OF LIGHT ON HEALTH.

WE cannot overrate the influence of *light* on health. A house that is constantly in a greater or lesser degree of darkness is, as a rule, unhealthy to live in. This is especially seen in houses that are placed low down, and in valleys, where the shadow of the adjacent hills keeps out the sun's rays for the greater part of the day. It is also seen in the case of small and low houses surrounded by tall ones, or in houses surrounded by too many trees.

Light plays an important part in carrying out the functions of all animal and vegetable life. When the sun fails to shine for two or three days together, we feel dull and depressed. When it appears again our spirits brighten, and we become once more happy. A blind beggar, on being asked what he most wished to see, replied, "The light of the sun." The first thing a baby takes notice of is light. He stares at the windows or at the candle or lamp.

In India, as a rule, we cannot complain of deficiency of light. In densely-populated and closely-packed houses, however, the light is often shut out. In some parts of the world, as towards the North Pole, people are for six whole months in utter darkness. Their day and night each lasts six months.

Light helps in many ways to make us happy. It enables us to see and love all that is beautiful in Nature. When we are happy, all things we do afford pleasure; we can then eat better, digest our food better, and take much interest in our daily work. We should remember that it is a large number of apparently trifling pleasures in life that make up this world's happiness. We should always endeavour to live in houses that are bright and cheerful. A plant that is deprived of light soon loses its natural colour and becomes pale and white. If two or three generations of this plant are produced under the same conditions, the plant dies out. In plants growing within houses, we notice that the growing leaves and the flowers always face the light, and even the entire plant itself tends to grow towards the light. The branches that cannot get any light wither away or die off. In the absence of light the nutrition of plants is interfered with.

In the chapter on AIR we referred to the green colouring matter of leaves* taking up the carbon and giving out the oxygen of the carbonic acid gas of the air. This change can only be carried out in the presence of light. In our own blood the red blood cells contain a colouring matter† which is able to take away the oxygen from the air and use it for the body; this also is best carried out in the light. In the absence of light we get pale, out of health, and subject to many diseases. Children dwelling in dark houses are often dwarfed in stature, thin, and weak.

If you wish to prevent a bird from singing you cover up its cage; a bird sings only when it is happy. In schools it is particularly necessary that there should be plenty of light.

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* This green colouring matter is called *Chlorophyll.*

† The colouring matter of the blood is called *hæmoglobin.*

The above refers to natural light—the gift of the sun. It is also necessary that we should have *artificial* light. This is supplied in the form of lamps (in which common or mineral oil is used), candles, gas, or the electric light.* Except in some of the large towns, gas has not been brought into general use in India yet. It may be said, however, that for convenience, wherever possible, gas should be used. Gas lights destroy more air than oil lights; therefore, in houses with gas we must provide for more ventilation. Mineral oil lamps give very good light. Special lamps are used for particular purposes, but it is the *reading* lamp, and lamps used for close work, that are so important. We shall refer to this shortly.

Large windows and properly placed doors allow lots of light, as well as air into the house. The inside of the walls of rooms should not be painted a dull colour. Abundance of light in a room will indicate where *dirt* lies and what places should be cleaned. Large doors and windows, further, allow light to enter rooms late in the evening, so that you save oil and candles.

It is exceedingly injurious to the health of women and children to be pent up in the small, dark rooms of some *zenanas*.

We must not, on the other hand, expose ourselves to the direct rays of a warm sun, without being protected by an umbrella and proper head-dress. Children often get severe fevers and headache from doing this. Those who have to work constantly in the sun for their daily bread get accustomed to it.

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* *Electric light* is produced by heating a suitable body to incandescence by causing a current of electricity to pass through that body. The substance usually employed for the purpose is carbon.

Snakes, rats, &c., come out in the dark. Abundance of light keeps them away. Schools should be always bright and cheerful. On one occasion a school was surrounded by a large number of tall trees, which prevented light entering the windows. The children were found to be constantly ill and dull. The trees were cut down, and the pupils recovered and continued in good health.

READING LIGHT.—The light for reading by should be steady, uniform, and sufficient in quantity, but not in excess; the print or other work on which the light falls, should be properly illuminated, but the eyes ought to be protected from the glare of the light itself. If these conditions are fulfilled, artificial light is no more injurious to the eyes than is daylight. If the eyes are normal, a person may go on using this artificial light for a considerable time. In many of the business offices in large towns in England, the work is carried on by gas light all day. The use of the common *chiragh* for reading, or any close work, is bad for the eyes; it gives a dim and varying light, and smokes. So is a single candle, but *two* candles protected by proper glass chimneys, are very convenient to use and not injurious to the eyes.

The lighting of streets is necessary to prevent accidents. No carriage or vehicle of any sort should be allowed to move at night without lights.

CHAPTER XI.

OFFENSIVE TRADES AND TRADES INJURIOUS TO HEALTH.

Slaughter-houses—Tanneries—Cemeteries.

ALMOST all offensive trades owe their unpleasantness and injurious effect on our bodies to the decomposition of animal matter. In this decomposition various foul-smelling gases are constantly being given off, which in some cases spoil the air of the entire neighbourhood; as an instance, we need only refer to the disgusting smells arising from badly-managed *tanneries*.

It is one of the privileges of all free people to be supplied with air. Air is not the property of any one person. No one has a right to contaminate his neighbour's air. It is not an outrage upon his neighbours if a man alone breathes the air he vitiates. But air obeys the laws of all gases, rapidly diffusing; therefore, all the inhabitants of an area in which an offensive trade is carried on are equally affected. In other words, the man engaged in offensive trades inside towns and *bustees* takes to himself the right to render unfit for breathing the air which is common property.

We would strongly urge the prevention of all such trades *within* villages, towns, municipalities, and cities; and further, that properly-chosen places be allotted for them.

We will now enter into the consideration of a few of these trades:—

SLAUGHTER-HOUSES.—Decomposition of animal matter and garbage is the chief cause of the injurious influence of slaughtering animals within inhabited places. In the process of killing, large volumes of blood flow over the ground and soak into it. Following this we have the clearing of the entrails, their contents being scattered about the slaughtering place; decay soon begins, and continues until the next day's slaughtering commences. If there are drains, the blood flows into them, but its offensiveness does not cease in them; for, instead of being limited to the area of the slaughter-house, it becomes diffused, and putrefaction of this animal matter goes on along the entire line of the drain. Such processes as these are bound to affect the health of those around.

Any one who wishes to verify these statements, and to ascertain the nature of the nuisance, has only to visit a large and neglected slaughter-house, that is, one neglected as to its sanitation.

In a large slaughter-house which we recently inspected several hundred sheep and goats are slaughtered daily. The offal, dung, &c., of the animals remain on the ground sometimes for days, and the soil is saturated with the decomposing blood that has soaked in it. The result is a condition unspeakably revolting.

In all municipalities, towns, and villages there should be a special place allotted for the slaughtering of animals. In villages this may be conveniently carried out under trees at a distance from the village; but in large municipalities, towns, and cities, it becomes necessary to erect proper slaughter-yards in the outskirts.

In making such slaughter-houses I would urge the necessity of attention to the following rules:—Slaughter-houses should be at least fifty yards from all dwelling-houses. They should be thoroughly ventilated by being in direct communication with the external air on all sides. In most cases, a simple shed surrounded by walls, of proper height, is all that is required. The beams of the shed should be provided with hooks on which to suspend the slaughtered animals. The site for the slaughter-house should be approved of by some person or persons in authority. Lairs for cattle should be provided in an adjoining yard. The floor of the slaughter-house should not be below the level of the surrounding ground. A cistern for abundance of water should be supplied to keep the place clean. The floor should be paved and covered with smooth cement, and should have a slope, inclining to a channel, which should be laid all round. The channel should run into a removable receptacle or to a smooth-lined cistern. The slaughter-house should be properly drained, both within and without. The surface of the walls in the interior of the slaughter-house should be covered with hard, smooth hydraulic cement, to a height of three feet. No water-closet, latrine, or cess-pool should be constructed within the slaughter-house.

Municipalities ought, as a rule, to undertake to keep slaughter-houses clean, and not depend on the butchers to do this. The slaughter-house should be cleaned daily.

TANNERIES.—The sanitary evils connected with the slaughter of animals do not cease in the shambles. Frequently, there are several other trades carried on close to the slaughter-houses. The chief of these is that of *tanning*. All tanneries should have in connection with them a complete and efficient system of masonry drains. Each drain should terminate in a main drain, and this latter should lead to a cistern of such capacity as to contain one day's refuse liquid All cisterns used should be built of masonry and lined with smooth cement. The cisterns should if possible, be covered. All the refuse material used in, and produced by, the trade should be periodicall removed. At the close of each working day, every part of the tannery should be thoroughly swept and cleaned.

Cemeteries.—The manner of the disposal of the dead of the large towns in India is a matter of great importance. It is now generally held that *cremation*, or the burning of the dead. is the most speedy, cleanly, economical, and wholesome method of paying this final tribute. But caste prejudices and custom among certain classes render disposal by burial for the present the most popular method. The existence of grave-yards is still inevitable. Regarding these we will lay down a few general rules.

In no case should they be placed within the town or village limits. They should be situated apart from human habitations, and yet not so remote as to be inconveniently far. They should be distant from water-courses and wells. The size of the grave-yard will depend upon the population and the annual mortality. It should be large enough to last for at least thirty years. It should be surrounded by good walls, and should be split up into a certain number of partitions. No corpses should be buried at a depth of less than six feet, and two bodies should not be laid in the same grave.

In certain towns, burial has been carried out entirely in populated areas. For example, in Hyderbad and Chudderghat there is scarcely a plot of ground 200 yards square in which a burial has not taken place. In many of the grave-yards, so closely have the bodies been packed, that in some cases, on removing six inches of earth, decaying human bodies are brought into view ; in other cases, even such disturbance of the soil is unnecessary. In digging a grave, it often happens that the pick-axe or other instrument used in the excavating process comes into contact with the skull of a decaying body. Such revolting occurrences as these should cause us to observe some rules with regard to the interment of the deceased, and if the above directions are followed a great deal in this direction will be effected.

SECTION II.

PERSONAL HYGIENE.

CHAPTER I.

THE SKIN.

Structure of the Skin—Cutis and Cuticle—Use of the Cuticle—Sweat Glands—Sebaceous Glands—The Hair—The Nails—Functions of the Skin.

THE phrase "personal hygiene" has a wide meaning, and refers to all those conditions of the body that can in any way affect health. It is convenient in this section to consider also the immediate surroundings of the individual, and their effect on his well-being. We have already said that the greatest reforms in sanitary matters are to be effected by the attention of each member of the community to all that concerns his personal condition and the state of his surroundings. Each person is responsible for the entire cleanliness of himself, his house, and its immediate surroundings. If he recognises this and carries it out, he will promise for himself freedom from sickness. We shall now pass on to consider the ways in which the personal condition may be affected.

To enable us to understand the manner in which the warmth of the body is kept up, the way in which clothes protect us from changes of weather, and the use of a daily bath, it is necessary for us to know something about the structure of the skin.

STRUCTURE OF THE SKIN.—*Cutis and Cuticle.*—The skin is composed of a *superficial* and a *deep layer*. The superficial layer is called the *cuticle* or *scarf skin*, and is that part which is raised by a *blister*,* or when hot water falls on it. The *deep layer*, called also the *cutis* or *true skin*, is made up of nerves and blood-vessels bound together by an elastic and fibre-like tissue. The superficial layer, on the other hand, is bloodless, and when damaged does not give rise to pain, nor does it feel heat or cold.

The cuticle consists of many layers of very minute flat cells. These are always being shed from the surface in the form of scurf, but are as constantly being renewed by the true skin situated beneath. The microscope shows us that the cells of the deep layers of the cuticle are round, and that these round cells become flattened as they approach the surface. There are millions of these flattened cells in a square inch of skin.

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* A *blister* is a part of the cuticle raised by the effusion of a serous fluid beneath, but here the term is applied to any agent capable of producing this effect, such as Cantharides or Spanish fly.

USE OF THE CUTICLE.—In all those parts of the body that are liable to friction and injury, such as the palms of the hand and soles of the feet, the cuticle is thick. By constant use the cuticle becomes hard and horny. People who have always worn boots and shoes cannot walk on rough ground bare-footed without discomfort, as we see some bazaar children do, whose feet have become hardened. The blacksmith handles hot iron without pain, and the mason works in lime without *corroding** his flesh.

In the deeper layers of the cuticle there is a olouring matter consisting of small dark granules; t is these granules that give the varying complexion o different races—the Negro of Africa has an bundance of them, the European only a small umber.

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* Corrosive substances are such as eat away whatever art of the body they are applied to.

Sweat Glands.—Beneath the true skin are situated the roots of the hair and two sets of glands,—one which secretes the sweat. and the other which secretes an oily substance that serves to keep the skin soft and the hair from becoming too brittle.

The sweat glands* are surrounded at their deeper parts by a large number of minute blood-vessels, from which they take that which is required to form sweat. They have small narrow ducts which open on the surface of the body by minute orifices, commonly called the "pores of the skin." About two and-a-half millions of these little pores are found on the skin of the body. Sweat is always being secreted. Sometimes it is formed so rapidly that it may be actually seen to ooze from the skin, but when we are cool and the amount of perspiration formed is small, we do not notice it, for it soaks into the horny layer of the skin and keeps it moist. This latter is called the *insensible* perspiration; it is constantly being evaporated from the surface of the body.

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* They are also called *sudoriferous* glands, from th Latin word *sudor*, sweat. Each gland consists of a minut tube, which at its deeper end coils up and forms small spherical body called the *glomerulus*, and from thi passes a wavy tube (the *duct* of the gland) to open on th surface.

SEBACEOUS GLANDS.—The second set of little glands in the skin are called *sebaceous glands* because they secrete an oily or greasy body called *sebum*.* These glands usually open near the root of a hair. The fatty material they form is conveyed to the root of the hair, and along it to the surface of the body. On the surface, it tends to decompose, giving rise to an offensive odour, and forming compounds, which, if not washed off, irritate the skin.

THE HAIR—Protects from heat and cold, and helps to shield the head from injury. It is found in almost all parts of the body, except the palms of the hands and soles of the feet.

THE NAILS—Are a modification of the skin, serving the purpose of protecting the tips of the fingers and toes. When dirt collects beneath the finger nails it should be removed; this removal is best carried out by a nail brush, soap, and water. The finger nails should not be allowed to grow too long. The toe nails should be cut nearly square.

FUNCTIONS OF THE SKIN.—The skin of an adult throws off about twenty ounces of water daily, but this quantity varies with the climate and season of the year. In the hot weather, and during severe exercise, for instance, this quantity may be lost by the skin in an hour. But sweat is not all water. It contains some solid, poisonous, waste matters, which, if not washed off from time to time, decay on the surface of the body. This solid matter, if not removed, tends to accumulate on the skin, and block up its pores.

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* From a Latin word which means *suet*.

The skin further serves to regulate the temperature of the body, and protect the deeper parts from injury. It also plays the part of a sentient surface for the reception of sensory impressions.

CHAPTER II.

EXERCISE.

Muscles—Need of Exercise—Effects of Exercise—Exercise for Children—Exercise for Boys—Exercise for Girls—Lawn Tennis—Swimming—Riding—School hours—Time for Exercise—Rest—Idleness—Sleep.

WE move our limbs with the fleshy parts of our body, which are called *muscles ;* those which are under our control are called *voluntary muscles*. There are about 500 such muscles in the body, each having its special use, and all working in harmony with each other.

MUSCLES.—Muscles have the power of contracting or decreasing, and relaxing or increasing in length. The muscles are nearly all arranged in pairs, each muscle having its opponent, so that when they relax and contract alternately, the bones to which they are attached are moved. If we bend up the arm and close the fist firmly, we feel a hard lump in front of the middle of the upper arm. This lump is the biceps muscle (of which school-boys are so proud, when it is well-developed) which has undergone contraction. If, at the same time, we feel the muscle at the back of the arm, we will find it relaxed and soft.

But there are other muscles over which we have no control, such as that of the heart and those found in the walls of the intestines and elsewhere: these are called *involuntary muscles.*

The voluntary muscles are composed of very fine red fibres, and these fibres are made up of very minute cells, which cells, at their lines of union, give the muscle a striped appearance. The cells are filled with a living, semi-fluid (protoplasmic) substance. The fibres themselves are bound together in *bundles*, and the ends of these bundles are usually hard and string-like, to fit them to be attached to bone.

We shall see what an important part the muscles play in exercising the body.

NEED OF EXERCISE.—By wisely and regularly using our muscles they get strong. Want of proper use, or their improper use, causes them to decrease in size. If we expose the blade of a steel knife to moist air for some time, it rusts, and if left long enough in such air, it becomes useless for the purpose for which it was made. The same is the case with our bodies. If the body is not kept clean, warm, properly exercised, and well fed, we become ill, weak, and may waste. Every part of our body must be properly exercised if we wish to keep healthy. Some people are naturally lazy, and as a result they are often ill. On the other hand, some people—very few—are too active, and waste away very much. Others again take too much exercise in one direction—using one set of organs or tissues too much, while they neglect the use of the rest.

EFFECTS OF EXERCISE.—Let us briefly enquire as to how exercise affects us. In sitting we breathe much slower than when running. When we breathe fast we take more air into the lungs, and, as we now know, the more the pure air that is taken into the lungs, the better purified is the blood. The heart also, during exercise, works faster, and drives this purified blood all over the body more rapidly than when we are breathing tranquilly: the waste matters in the tissues are removed more rapidly, because the blood washes them out of the body more speedily. The body is, therefore, better nourished by exercise. All these effects give us a good appetite and increased power to digest our food. Those who eat to excess, and take but little exercise, are often ill; they become indolent and frequently grow fat.

After the brain has been working for several hours it contains a lot of waste matters and requires rest. These waste matters interfere with the proper action of the brain, that is, with the mental processes. Exercise is the best means of getting rid of these bad matters, for by it we send a fresh supply of pure blood to the brain, which, in going back to the heart, carries away the waste matters—the blood washes them out as it were.

EXERCISE FOR CHILDREN.—Soon after its birth, an infant commences to move its limbs about, and this has the same effect on the child's system as the more vigorous forms of exercise have on older people. All children should be allowed and encouraged to play games that give them exercise, especially games that need walking and running about. All games with balls are very good for this purpose. The merriment of children whilst playing should not be in any way constrained; they should be allowed to laugh and shout as much as they desire.

EXERCISE FOR BOYS.—There is a great tendency throughout India to keep boys constantly at their books. It is necessary for all children to attain a certain standard of mental education, but to effect this the bodily training should not be sacrificed. We know that the examinations of the present day are difficult, but studying and reading day and night are not the best means to overcome this difficulty. It should be remembered that a lad can, as a rule, learn in eight hours of the day as much as he can in twelve hours; and eight hours *fixed attention* is as much as a lad can be expected to go through in the twenty-four hours. Even with this, some boys will break down. A boy who is permitted to have but little leisure for play grows up effeminate, and there is about him a general want of manliness.

It is well always to keep in mind, that the nature of the *physical training* that boys and girls undergo before their seventeenth or eighteenth year determines the kind of men and women they will mature into.

Boys, later in life, are frequently called upon to work hard for their daily bread: when young, therefore, they should be induced to do those things that will give them, at least, a certain amount of physical endurance. To enable them to live, most men are obliged to use both their mind and body. In this particular, man is differently circumstanced to the rest of the Animal Kingdom. For instance, man is obliged to weave clothes for himself from plant fibres or from the hair of other animals, to make implements of defence, to cook his food, &c. The lower animals need none of these things; they are already provided in a suitable condition by Nature. It is only by the use of the brain and muscles that these things can be done. You may say that savages wear but little clothes, and are not skilled in our arts and sciences, yet they are very powerful. Yes, this is true; but they are defective mentally; they do not use their brains. The result is that most savage nations cannot defend themselves against nations that use both their brains and muscles. Such savage races are gradually dying out, because they are being exterminated by more intelligent races.

In some countries, boys, from the earliest period of their school-days, are put through regular courses of artificial exercises or gymnastics, which, from the *time* they take up, almost entirely exclude them from the more natural movements obtained by running, jumping, &c. We consider that such a system is not altogether a wise one. Nothing can replace the natural movements obtained in such recreations as those of cricket, football, rackets, fives, rowing, lawn-tennis, jumping, and swimming, for boys in health. At the same time, gymnastics ought not to be entirely neglected. There are many unfortunate boys who, from continued illness, physical defects, and delicacy of body, cannot engage in the ordinary course of such games and recreations as we have enumerated.

without much injury to themselves. To them these gymnastic exercises, regularly carried out under proper supervision, are much the more beneficial.

In the case of *healthy* boys, as a rule, no restriction need be placed on the *kind of exercise* they take in the way of games, but the *amount of exercise* ought to receive attention. Particularly is this the case with running about, as long-continued running taxes the heart very much. In many schools we believe that more exercise than is good for lads is indulged in.

For *purposes of exercise, boys ought to be classified.* It is a cruel thing to allow strong and weak boys to play together and compete with one another in every-day games. Such a practice is highly injurious to delicate lads, who, in their attempts to excel their stronger and hardier school-mates, are called upon for exertions to which they are unequal.

The *time* for taking exercise at school ought also to be regulated, so as not to interfere either with the mental training or with the digestion of the food.

EXERCISE FOR GIRLS.—The physical training of girls in Indian schools has hitherto been much neglected, and we would urge, for the sake of the present and future generations, that a little more attention be paid to this matter. In the present day, we find girls and women entering into competition with the opposite sex in the race for bread. Under such circumstances, their powers of endurance—mental and sometimes physical—will often be put severely to the test. There are certain walks of life, of course, in which women are as eligible for employment as men; but these, in our opinion, are not such as call for the highest form of physical ability. Nevertheless, it is necessary that all girls at school (and in their houses, if they do not attend a school) should be put through a course of systematic physical training.

Many of the games and exercises in which boys take so much delight would be equally suitable for girls. As instances of suitable exercises for girls, we have gymnastics, rackets, fives, rowing, walking, running, swimming, riding, and lawn tennis.

LAWN TENNIS—Is a game that should be regularly taught to girls in schools, in the same way that cricket is taught to boys in public schools.

SWIMMING—Is an exercise peculiarly suitable for girls, as it brings into play, without too much strain, almost all the muscles of the body.

For deportment and grace of carriage, there are few better exercises than *rowing*, and it should be systematically practised wherever an opportunity for it is afforded.

RIDING, too, is good exercise for them, for it refreshes both the mind and body, but it ought not to be indulged in too much, until growth has almost ceased.

To take advantage of any of these exercises or games, however, without risk, it is necessary that all constriction of the chest, abdomen, neck, and feet be dispensed with.

One of the great difficulties in securing proper exercise for girls and women is the expense that attaches to most of the pursuits we have enumerated. Another difficulty rests in the fact that women and grown-up girls cannot play about in open fields like men and boys.

With regard to gymnastic exercises, we may say that they are the best form of in-door recreation for girls; but they should be carried out under strict supervision, and all feats practised should be such as do not put too much strain on any one part of the body. All such exercises should be carefully selected, and they should never be indulged in to excess.

The remarks we have made with regard to the games and pastimes for girls apply equally to boys, with this difference, perhaps, that boys do not require the same rigid supervision that girls do.

SCHOOL-HOURS.—Too long school-hours are bad for children. The hours of learning should be properly proportioned to the hours of play. When in school their *positions* should be frequently altered. Some lessons should be heard, taught, or learnt *standing*. Children should not have their whole time out of school taken up with learning lessons.

TIME FOR EXERCISE.—We should not take any severe exercise after long abstinence from food, nor immediately after a meal. There is an old-fashioned prejudice in favour of exercise before breakfast: this may be suited to the strong and healthy, but it is entirely unfitted for the weak and delicate. On first rising in the morning the pulse is low, the skin relaxed, and the system subjected to cold and depressing influences. Feeble persons, therefore, need to be well braced up with food before going into the outdoor air in the early morning.

People who have passed the age of thirty-five years should avoid all such exercises as call for violent or prolonged muscular strain. After this age the different organs are not so elastic as they were at an earlier period of life, and they do not recover the discomforts of over-exercise so readily. They should be specially careful in entering competitive games demanding considerable and sudden exertion.

REST.—Rest differs from idleness; it is a necessity after a certain amount of any kind of labour, mental or physical. When we are tired of study and all kinds of mental work, wearied of muscular exercise and of recreation, we seek "Nature's sweet restorer," —sleep.

IDLENESS is an evil habit that fosters others of the same class. Rest does not always mean that we should be lying down or doing nothing. For instance, say a boy has been working at arithmetic for a few hours; he gets tired of this subject, and it becomes necessary for him to rest. This does not mean that he should go to sleep; if he works at some other subject he gets rest. A blacksmith who has laboured at the forge all day gets rest, when he reaches home, by reading.

Idleness is the parent of many diseases. There is never any necessity to be idle: we should always endeavour to be doing something useful, something that will benefit the body and the mind. During festivals in India we see men (and even women too) getting drunk and behaving in a disgraceful manner. They are then subjecting themselves to all manner of disease-causes. They could surely spend their time and money more profitably than this.

Sleep.—A time comes when both the mind and body get tired, when we feel that we want a general rest, which is obtained in *sleep*. Sleep is the most profound form of rest we can partake of. It is a negative food for the brain; it retards the activity of all the processes in the body, but especially does it retard the working of the brain; it slows the fires of the system, and therefore lessens the consumption of fuel. But even in sleep all the essential functions of life* or vital action are carried on uninterruptedly. During sleep less blood goes to the brain. Sleep comes naturally to the tired body and mind; it is not necessary to search after it. By sleep we ought to be refreshed and comforted, and on waking in the morning we ought to wake up like new people.

In children, sleep comes in a few moments after lying down at night and keeps on till next day. Many things tend to interfere with the sleep of adults. If we are too tired physically, or have had much mental worry, grief, or anxiety, sleep keeps away. Many people go on bothering themselves about their work after going to bed: this prevents sleep. Others read till too late an hour at night;

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* These are the functions of the *heart* (circulation), *lungs* (respiration), and *brain* (innervation of former two); they constitute what has been called "the tripod of life."

this is a bad habit, because it keeps an excess of blood in the brain, whereas sleep needs a decrease of this fluid there.

Foul air in a room may often prevent sleep. In India, we often see huts that are too small for two people occupied by five or six. The air in them is poisonous. It may be too expensive to get enough cubic space in a house, but there is no excuse for absence of proper doors and windows which ensure good ventilation. Much of our health depends on getting a proper and wholesome sleep—a sleep to refresh and not to depress us.

Never eat a full meal just before going to bed. Our last meal should not be taken later than seven in the evening. If we eat a full meal just before retiring, our sleep is restless, heavy, and full of horrid dreams. This dreaming shows that the brain is not getting its proper rest. We should place no trust in dreams; they do not mean anything.

Some people sleep too much, others too little. The more the physical or mental work which is gone through, the more is the sleep required. Those who have to work hard all day for their living, and for hours at night as well, scarcely get enough sleep.

Infants require abundance of sleep. They may be permitted to sleep a good part of the day as well as all night. Children require much more sleep than adults. Girls and boys about twelve years of age require at least nine-and-a-half or ten hours sleep out of the twenty-four. About seven hours is enough for a man and eight for a woman: some men, however, require eight hours. Sick people and convalescents require more sleep than the healthy.

Night is the time for sleep for adults. "Early to bed and early to rise, makes a man healthy, wealthy, and wise." We should not retire later than 10 o'clock at night nor get up later than 5-30 o'clock in the morning.

CHAPTER III.

CLOTHING.

Style—Excess—Changes—Selection—Light and unsuitable clothes—Children's clothing—Sufficiency of clothes—Linen—Cotton—Woollen materials—Silk—Warmth of clothes—Colour of clothing—Underclothes—Bedding—Bedding and Pillows.

THE main objects of clothing are to cover our bodies and to protect us from external influences; these influences are chiefly cold, heat, and damp. Many of the diseases from which we suffer are due to changes of weather and imprudence about our clothing during these changes. Cotton clothes, for instance, would be altogether inadequate in the cold weather, and would lead to colds, coughs, liarrhœa, chills, fever, &c. The nature of the clothng we wear ought to vary with these external nfluences—that is, with the weather. The changes f weather are extreme in the Punjab and the orth-Western Provinces, and these changes should ause us to wear different kinds of clothes at lifferent seasons. The only exception to this rule is he use of flannel clothing: flannel may be worn ith benefit all the year round. Clothing in winter serves to maintain the warmth of the body and to exclude the external cold. In summer, on the other hand, clothes serve to keep us cool. They should not absorb the rays of the sun, and should permit of the radiation of the heat of the body.

STYLE.—During the hot weather, we should always protect ourselves from the direct rays of the sun. Clothing should always be porous to allow escape of perspiration and access of air to the skin. We can readily apply these essential conditions to the different kinds of wearing apparel. It is quite right to wear light and white cotton clothes in the heat of the summer or hot weather. The white colour reflects back the heat, and thereby tends to keep us cool. These clothes in the winter will not suit. In cold weather it is always wise to wear under-garments of flannel: and even in summer, it is well to wear merino, or a mixture of cotton and wool, or silk and wool. The roughness of wool is sometimes disagreeable and objected to by the wearer, but habit soon overcomes this sensitiveness. Those who are weak and delicate, and especially those who are prone to chills, cannot be too cautious in keeping their bodies warm.

EXCESS.—It is almost quite as great an error to be overburdened with clothes as to be too lightly clad. Too many clothes render us more liable to chills when we expose ourselves. Further, too much clothing impedes the freedom of action of our limbs. We should wear light clothes round the chest and neck. The head-dress should be light, and yet sufficient to protect us from the heat of the sun. The clothes worn during the day should never be worn at night in bed. The clothes we have been wearing usually require to be aired and dried before wearing them again.

CHANGES.—In certain parts of India, it is cold at night and warm during the day. In such places, the same clothes are not suitable at both periods. Never wear dirty or soiled clothes, especially soiled under-clothing. If we chance to get wet in the rain, or have perspired so profusely as to moisten our clothes, we should change the damp clothes for dry ones as soon as possible. If we cannot manage to do this, we should keep moving about briskly until our clothes are dry. Sitting down, or lying in wet clothes, is liable to bring on fever, rheumatism, diarrhœa, or other complaints. If we return home in damp clothes after a long walk, we should not immediately expose ourselves o cold air or to a working *punkah*. We should never sleep in damp sheets or damp bedding of any description, as this may lead to serious iseases.

SELECTION.—In buying clothes, it is necessary to hink of two things—their *usefulness* and their *appearance.* Usefulness comes first, but we should endeavour to combine these qualities.

TIGHT AND UNSUITABLE CLOTHES.—No part of our dress should give rise to pressure or constriction of any kind. In this respect, the dress of the inhabitants of India is superior to that of the Europeans coming to the country. Tight cravats, collars, and necklaces, constrict the neck, and prevent the free flow of blood; they also give rise to headache, giddiness, and sometimes even to fainting. Garters should not be tight, and should be made of elastic material. Neither the chest nor the abdomen should be in any way squeezed by constrictions of any description. The use of stays or corsets is highly objectionable; they create serious results by interfering with the action of the stomach, intestines, heart, and lungs, giving rise to fainting fits, indigestion, constipation, difficulty of breathing, &c. The shape and make of the dress of the people of India is, on the whole, very suitable to the climate. An important point, and one that is often neglected, is the use of warm clothing in the cold weather; this deserves more attention than it receives. The *shoes* worn by the people of India are really of much better shape than those worn by the people of the Western countries. All parts of the surface of the body, except the head, should be equally clad. Whatever fashion demands, no part that is covered to-day can remain uncovered to-night or to-morrow, except at the risk of health.

CHILDREN'S CLOTHING.—It is very wrong and cruel to leave the limbs of little children uncovered and exposed to chills. We believe that many diseases of children in India are due to such exposure. Children should not be thinly clad with the object of "hardening" them: the vigour and power of endurance of children is increased by food and exercise, and not by exposure. In winter there is always more fear of their being too lightly than too heavily clad. Above all, it is most important in winter that the feet be covered with properly made shoes, with thick soles, and good woollen or merino socks. When the ground is damp the same precaution is necessary.

SUFFICIENCY OF CLOTHES.—After severe exercise it is always wise to put on extra clothing at once.

Never change the clothing abruptly from very heavy and warm garments to cool ones, unless the change of weather be abrupt. Under all circumstances, the clothes should be sufficient to keep us warm and comfortable; especially is it so in the case of old, delicate, feeble, and convalescent people, whose circulation is weak. Clothes are usually made of one of the following fabrics :—*Linen*, *cotton*, *wool*, *and silk*.

LINEN is soft to the touch, and is a good conductor of heat, hence it is pleasant for summer wear. When we are perspiring, it is very apt to chill the surface too rapidly, hence it should not be worn next the skin.

COTTON is not so good a conductor of heat as linen, nor does it absorb moisture so readily; it is, therefore, a little "warmer" than linen. It is pleasant for hot weather wear, and perhaps gives a slightly better protection against chills than linen.

WOOLLEN MATERIALS absorb a considerable amount of moisture, and contain much air in their meshes: they are bad conductors of heat, and protect the wearer from sudden changes of weather.

SILK is even better than wool as a wearing material. It is light, smooth, and soft: further, it absorbs water, although less than wool does. It is an excellent covering for the surface, and by all those who can afford them, silk underclothes may be worn with benefit. They have all the advantages and none of the irritating qualities of woollen materials. The first cost is greater than that of flannel, but silk lasts longer, for pure silk fabrics are very strong and durable.

WARM CLOTHES.—The warmth of clothing largely depends on the amount of air contained in the meshes between [its fibres; fine, loose, porous cloth, with plenty of nap, is best for winter wear. Heavy clothes are not necessarily the warmest. Furs are the perfection of Winter clothing in very cold countries, since they combine warmth with lightness. Remember that two light, warm, woollen garments, one over the other, are warmer than a single heavy one, as there is between them a layer of non-conducting air.

Colour of clothing.—The amount of heat absorbed from without varies with the colour of the clothing. Dark substances will absorb more heat, and therefore are warmest when the external heat is great. This is why, on a hot weather day, a black-coloured coat in the sun is almost unbearable. Further, dark clothes *radiate* much heat; therefore in winter they tend to abstract heat from the body. Light-coloured clothes reflect more of the sun's rays, hence they are cooler in summer than dark-coloured clothes.

Underclothes, or clothes worn next the skin, hould be of some woollen material or silk; especially s this needed in infants, young children, old people, nd those who are feeble. All underclothing, worn during the day, should be taken off at night. Coloured flannels, worn near the skin, have no pecial virtue in protecting from cold; on the other hand, they have disadvantages. For instance, they do not show the dirt, and may appear clean when aturated with the waste matters from the surface of the body. Further, some brightly-dyed flannels contain colouring matters which are injurious to the skin, creating different forms of eruption. Some of these dyes are prepared from arsenical pigments, and are, therefore, actually poisonous. We should remember that coloured clothes, as well as white ones, rapidly absorb perspiration, and for this reason soon become dirty; they should, therefore, be changed as frequently.

BEDDING.—Considering that we pass about one-third of our lifetime in sleep, it is important that we should be as comfortable as possible when asleep. A vast number of people in India never use a bedstead of any kind; the floor of the hut or house, or the bare ground outside, is used instead. Many diseases arise from this practice. A damp floor or ground predisposes to fever, dysentery, rheumatism, and other diseases. We know that the malarial air is heavier than ordinary air, and therefore lies near the surface of the earth. It is said to "love the ground." When on the ground, therefore, in a malarious place, we are in direct contact with the malarial poison. An instance of this was shown in the case of a number of labourers in Italy who were digging up a new soil: so *saturated*[*] with malaria was the air close to the ground, that many died ery soon from its effects, whilst those working on a igher level escaped. We should remember also hat snakes crawl along the ground, and if in their oamings they meet with an obstruction they will ite. Many cases of snake-bite in India occur from nakes meeting men sleeping on the ground. As a ule, a snake will get out of the way, but if obstructed, s they would be by persons sleeping on the ground, hey act in what appears to them to be self-efence.

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[*] *Saturated* here means holding as much as it could in the aerial form.

If possible, we should never sleep on the ground : se a charpoy or bedstead of some kind. A charpoy not expensive. It is always advisable to use some ort of covering in all weathers. Blankets are eeded in winter.

Mosquito curtains are very useful for warding ff mosquitoes and other insects ; they also prevent hills by filtering the dew of the air, and thereby essen the chances of malarial air affecting us, that , they catch the moisture of the air which so eadily produces cold or chills.

The *sleeping-room* should always be apart from the enerally used rooms, and it should be well ventilated. he nature of the air in a bed-room largely deter-ines the health of the people occupying it.

BEDDING AND PILLOWS.—These articles should ways be kept clean, and should be exposed to the r every morning after use, to purify them, as some of the waste matters of the body adhere to them during the night.

If not too cold, the windows and doors should be kept open at night. Sleeping in a close room is bad for health; it prevents proper rest, and it causes us to get up weary and unrefreshed, instead of refreshed, vigorous, and brilliant.

We should not sleep with the head and face covered with the bed clothes. This filthy habit necessitates the breathing of the same air over and over again.

If the air is damp we should not sleep out of doors at night. Damp air causes many diseases, but chiefly fever, dysentery, and rheumatism.

In the hot weather, it is really dangerous to sleep outside *on the ground*, although it may be harmless to sleep on charpoys, for the reasons we have already stated. A high house is better than a low one to sleep in, because it is at a distance from the malarial poison which floats near the ground.

In the absence of a charpoy, if we are obliged to sleep on the ground, we should use some straw, or at least a water-proof matting.

CHAPTER IV.

BATHING.

Necessity of Bathing—Time for Bathing—Effects of cold water in Bathing—Hot Bath—Warmth.

WE have seen that the normal secretions of the skin tend to accumulate on its surface and make us dirty; but the skin may be soiled in other ways—by the dust of the air and by coming into contact with such impurities as we may work in. All these have to be removed; if they are not, the functions of the skin are imperfectly performed, and its work has then to be carried out by other organs. If the blood-vessels in the true skin are contracted by cold, they cease to supply the fluid and other bodies that go to form sweat: if the waste matters that are usually removed by the sweat are locked up in the body, we are rendered liable to various forms of disease. The pores of the skin, when in action, help to purify the blood. The skin, in many diseases, is the main channel for getting rid of the disease poison;—in small-pox, for instance, the eruption is caused by Nature's effort to throw off the poison by the skin.

NECESSITY OF BATHING.—All these facts point to the *necessity of bathing from head to foot at least once a day.* We learn this lesson from the brute creation and from birds, who may frequently be seen resorting to water to wash themselves.

TIME FOR BATHING.—The proper time for bathing is just after rising in the morning. At that time the body is warm and can tolerate cold water better than at any other period of the day. After the night's rest. the body is relaxed and needs bracing, and the nerves, rendered sluggish by the night's repose. require gentle stimulation.

EFFECTS OF COLD WATER IN BATHING.—The system, when in health, is strong enough to resist the shock produced by moderately cold water. The cold bath in the morning refreshes and brightens us up, and makes us feel energetic and fit to go through the day's work. The first effect of the cold water is a slight shock, which is rapidly followed by a pleasant general glow of warmth and a feeling of increased vigour. It helps the oxidising process, and hastens the functions of the internal organs. But a cold bath is not safe for all persons. Delicate people, those who are recovering from sickness, those subject to chills, ague, or fevers of any description, to diarrhœa and dysentery, and other internal complaints, and all aged people, should avoid the cold bath.

HOT BATH.—A warm or *hot bath* is necessary, at least, once a week. *Soap* should be used frequently. Some of the waste matters that cling to the skin are, as we know, of a fatty nature. Fat does not combine with water, but soap easily mixes with the greasy matter secreted by the sebaceous glands, uniting with it, and thereby enabling the water to wash it off.

Soap is made up of fat,* or oil combined with an alkali,† which is usually soda, potash, or lime. In all soaps there is a certain amount of the alkali free (that is, uncombined with the oil or fat), so that when soap is rubbed with water on the body, the spare alkali combines and forms a lather with the fat of the surface, and is then easily removed. Soaps containing too much alkali are irritating to the skin, and that made by *lime* is often injurious, as it brings about a roughness of the surface, and sometimes causes eruptions; therefore, *avoid the use of lime soap.* The least irritating soaps are those made from glycerine; these often, in fact, give a softness and freshness to the skin. Soaps are often mixed with perfumes and colouring matters to make them agreeable to the sight and smell; such soaps should be avoided. Further, never use a chemical or medicated soap unless it is ordered by a doctor.

After the cold bath there should be a speedy *reaction.* The cause of this is, that when the surface of the body is cooled by cold water, the blood, driven into the heart and other vital organs, excites them to more vigorous action, and being thrown back to the surface, it reddens and warms the skin; it is to this pleasant and invigorating influence that the good effects of the cold bath are due. On the other hand, if the skin be heated, as it is in the hot bath, the blood comes to the surface in abundance, less goes to the heart, and other internal organs; the blood-flow is lessened and languor ensues. A dash of cold water is both necessary and refreshing, at the close of the warm bath, to counteract these effects. If a cold bath is succeeded by a continuous chillness and depression, it indicates that either proper means were not taken to bring on this reaction, or that the circulation is not strong enough to stand it; under these circumstances, the cold bath should not be persevered in.

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* *Fat* is an oily concrete body contained in the adipose tissue or cellular membrane of animal bodies. Fat consists of stearine, olein, and palmatin. These are complex compounds composed of *glycerine* and a *fatty acid.* When boiled with alkalies the fat is decomposed, the fatty acid uniting with the alkali to form a soap.

† The term *alkali* is used to denote various classes of bodies having the following properties in common: they are soluble in water, they neutralise acids forming salts with them; of corroding animal and vegetable substances and altering the tint of many colouring matters; thus, by them, litmus paper, reddened by an acid, is turned blue, and turmeric, brown. The term *alkali*, however, is generally applied to bodies having the power of neutralising acids.

After a cold bath, before dressing, the whole body should be thoroughly rubbed with a coarse towel. At first the friction may be unpleasant, but this will soon be replaced by the lively glow which succeeds. A cold bath should not be taken for at least two hours before or after a meal, at such period it would interfere with digestion. A cold bath should never be taken when the body is fatigued by exercise. Infants cannot stand the cold bath, but children may gradually be accustomed to it. A cold bath should never last longer than *five minutes*, and usually two or three minutes will be sufficient. Elderly people benefit more by the tepid than by the cold bath. We should avoid bathing when the body is *cooling* after perspiring, but we may bathe when the body is warm, provided no time is lost. Always leave the water immediately there is the slightest feeling of chilliness. Those who are subject to giddiness, faintness, palpitation, or cramps, should always consult their doctor before adopting the cold bath.

In warm weather the *feet* require special attention; they perspire freely, and may become offensive if not frequently washed with hot water and soap, and the socks changed daily.

Frequently ablution or immersion of the body in water is one of the best ways of keeping ourselves free from disease, indeed, we cannot keep in perfect health if we neglect this. A frequent change of clothing helps to maintain the body in a clean condition; but this latter can only be perfectly effected by a daily bath. The scale-like particles from the outer layer of the cuticle are constantly falling off and becoming entangled in our clothes, and the underclothes wipe off some of the dirt which remains in the meshes of the clothes: we should, therefore, change our clothes (particularly our underclothing) frequently, and they should be thoroughly washed before being again used.

It is well to wear light-coloured material near the skin; we can then *see* when they are dirty. If coloured material is worn next the skin we should remember that they require to be washed as frequently as if they were white. Clean skin and clothes make us feel clean and comfortable. Dirty people,—those who keep neither their clothes nor their skin clean,—always feel uncomfortable. They may often be seen scratching themselves; this is because the accumulated waste matters irritate the skin. In a family of several children it may appear to be a great labour to attend to these things, but it is work done for a good purpose, and will amply repay the trouble taken. It helps to keep the children free from disease. Clean children show that they have attentive, clean, and careful parents. Such children are happy, whereas dirty children are frequently ill-tempered. Mothers should teach their children to like their bath, and should explain to the little ones why the bath is used. If our work makes us dirty, we should always clean ourselves when it is over. Any child who has a healthy, well-washed skin, a bright, cheerful appearance, white teeth, and neat clean clothes, will be pleasant to look at.

WARMTH.—One of the objects of wearing clothes is to keep our bodies at an even temperature. Clothes are spoken of as "warm" and "cool," but all clothes are of the same temperature. If you wrap up a chair in a blanket, the chair does not become warm; it remains at the same temperature. If we wish to keep the tea in a teapot warm, we place a cosy* over the teapot; but even this can only keep the tea warm for a certain time. Whatever is warm is constantly giving out heat to the surrounding air. We are born warm, and we have warmth within ourselves. Further, as constantly as we are losing heat, we are forming more inside the body. All agents which touch something warmer than themselves take away some of the heat from the warmer thing. If it takes away this heat rapidly it will soon render the warm body cold. If we place a hand on a marble table, we will find that the part that touches the table rapidly becomes cold, and that the table where touched is warmed; but if we place the hand in a piece of flannel or in woollen gloves, we find that the flannel removes the heat of the hand very slowly. Some things carry away the heat from other bodies rapidly, others slowly. Let us touch a stone, a piece of iron, wood, wool, or flannel, one after another, and we at once notice how quickly the heat of the hand goes to the stone and iron, and how slowly to the wool and flannel; yet all convey away some of our heat. The clothes we wear, no matter of what kind, are being constantly heated by our bodies. We heat them, not they us. By warm clothes, we mean the clothes which conduct heat away from the body less rapidly than "cool" clothes. Notwithstanding that we give off a lot of heat in this way, we keep about the same temperature. In health we never get very cold or very warm. In cold weather, when out walking, we are always giving off a lot of heat, yet when we return to breakfast we shall probably be warmer than when we went out. This is because we are constantly forming heat; everything we do, every movement we make, generates heat. Even when apparently at rest, many important organs are acting; for example, we are breathing and the heart is acting. In *death* all these processes cease; no part of the body then moves, and as heat formation is stopped, the body soon becomes as cold as the surrounding air.

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* A *cosy* is a thick flannel, cloth, or cotton wool covering, for a teapot.

The heat of the body is formed by the union of the oxygen we inspire with the food materials we eat. Whenever oxygen combines with any other agent, it causes the newly-formed body to become warm, whether it burns with a flame or not. In the burning of a lamp, the oxygen of the air unites with the different elements of which oil is composed. The carbon of the wick and oil form with the oxygen of the air, carbonic acid gas; the hydrogen unites also with the oxygen to form water. In this case the oxygen unites so quickly with other bodies that it burns into a flame.

There is plenty of carbon and hydrogen in the human body combined with other things. When the oxygen of the air comes into contact with them, they join with it, and in doing so, produce heat. But they do not do it so fast as in the case of the lamp; no flame is produced; it is a slow process of oxidation or combustion. The heat thus created is just sufficient to keep us in health. Thus, the formation of heat is going on in all parts of the body. The faster we move the more burning goes on.

Some parts of our bodies burn more rapidly than others. These we might think would be much the warmest. Yet, although they are for a moment a trifle warmer, they disperse this heat so rapidly through the medium of the blood, that they retain, practically, the same temperature as the rest of the body. The little blood-vessels in the heated parts, in addition to conveying nourishment, also carry oxygen and heat. If one part of our body is getting too cold, from parting with too much heat, the blood-vessels of the other parts then convey warmer blood to the cooler parts, and if another part is too warm, the cooler blood from other parts is distributed to it.

On the other hand, some parts of our body, as the skin and structures just below it, are constantly giving away heat. We might think that they should be much the colder. In this case the warm blood from the interior of the body rushes to the surface to equalise the temperature. Thus, the body is kept at a uniform temperature. The blood never stays in one part long enough to get either very hot or very cold.

In health, we form as much heat as we give out, unless sitting still in a cold room. Old men and women, infants, and weak or delicate people, cannot create heat rapidly in the body; they require abundance of warm clothing in cold weather, and in many places in the winter they require artificial warmth, in the shape of fires within the house, to keep them warm.

Many serious diseases especially are caused by cold—fever and inflammations. These inflammations are caused by too much blood being in one place and *remaining* there, and not running through the blood-vessels as it ought to do.

But some people cover themselves up too much at all times, and thus become liable to changes of weather. People who are constantly muffled up about the neck are liable to sore throat, bronchitis, &c. Many children are constantly kept in-doors during the cold weather, for fear of their catching cold; such children really become very subject to sickness, and from want of out-of-door exercise and freedom or play, they often pine away.

Cold air, acting on the skin, lessens the perspiration. On looking at the skin, under the microscope, we find crowds of little vessels there. These little vessels supply the fluid that forms sweat. If, when the sweat is being formed, we get a chill, these little blood tubes contract, and stop giving out the watery fluid for perspiration. In contracting, the blood is sent into some other organ, and may cause it to inflame.*

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* Inflammation is a state of any portion of the body characterised by heat, pain, and redness, attended with more or less swelling and fever.

SECTION III.

DISEASES.

CHAPTER I.

CONTAGIOUS AND INFECTIOUS DISEASES.

Epidemic Disease—Sickness—Care of the Sick—Surroundings of Sick persons—Food of the Sick—Common Indian Diseases—Ague, Intermittent Fever, or "Thup"—Precaution against Malarial Poison—Chicken-pox.

THE term *contagious* is usually applied to a disease that is capable of being communicated to, or "caught" by, healthy persons from actual contact with one affected. The term *infectious* is mostly applied to diseases that are communicable through the air. These terms are, perhaps, enough to show what is meant in a general way, but the use of either alone is often incorrect. Many diseases of this nature are, in their early stages, hard to diagnose from ordinary diseases. In all cases, therefore, of any disease of a serious kind, and in all that we are doubtful about, we should send for a doctor or send the patient to hospital. The doctor may, even in this first stage, be able to state the exact nature of the disease; he may, for instance, be able to state that small-pox is coming on, and by having all the unprotected members of the family vaccinated, avert the spread of the disease in the family and in the neighbourhood. We have seen the most satisfactory results from this timely vaccination. The same holds good with regard to *cholera;* the doctor may be able to recognise this disease at once, and will take those precautions that his experience tells him are necessary to prevent the spread of the disease, and may thus help to stop a severe epidemic of it.

EPIDEMIC DISEASE.—Every now and then we have dreadful outbreaks of disease which attack many persons at the same time and in the same place, spreading far and wide. Diseases beginning and spreading in this way are called *epidemic diseases.* Such was the great outbreak of cholera in India in 1889, and of small-pox in Madras in 1883.

Some diseases occur in certain places only, and are more or less constantly present in those places; they are then said to be *endemic* diseases. Of this kind we have in India malarial ailments—ague, remittent fever, enlarged spleen, dysentery and diarrhœa, goitre, and stone in the water passages.

Epidemic diseases are almost, if not entirely, preventable, and most of the endemic diseases are, to a large extent, under our control; we can lessen their severity and prevalency very much. We learnt in the INTRODUCTION that some epidemic diseases have entirely disappeared from certain countries, and that *endemic* diseases had ceased to exist in others. About thirty years ago the English soldiers in the old Secunderabad barracks used to suffer very much from dysentery. Government inquired into the reason and found that this was due to bad drainage, overcrowding, organic soil, and defective hygienic arrangements.

They built new barracks, with proper drains, prevented overcrowding, and gave more attention to sanitary matters generally, with the result that dysentery is now no more prevalent there than it is in other military stations of India.

All over India the British Government is looking after the sanitary welfare of the people; it is constantly finding out new sources of disease and removing or abating these sources.

SICKNESS.—Much of the sickness of Indian towns and villages is due to preventable causes. It may appear unnecessary to repeat this so often, yet we know by experience that many people, through ignorance or indifference, do their utmost to create sickness. It is much better and wiser to keep healthy than to court disease.

Sickness is not always preventable, however; and when we are ill, we ought to know what to do to bring about a speedy return to health.

When we are sick we ought to consult a medical man at once, or go to a hospital to be treated. We should never trifle with ourselves in this state; even slight ailments are sometimes followed by serious illnesses. In all contagious and infectious diseases seek medical aid at once. If we are suffering from dysentery, diarrhœa, or cholera, we should apply for treatment as soon as possible. If taken in the early stage, such diseases are far more readily cured than if they are allowed to run on.

Many slight diseases only require rest and a particular kind of diet. When ill we should stop work, as the body requires rest, and take light diet only, such as milk or *conjee.* In sickness we should not rush at every suggestion our friends make and take all kinds of remedies.

CARE OF THE SICK.—We have had frequent opportunities of seeing the many miseries and discomforts that go hand in hand with sickness in the houses of the poor people of India. What we witness, as a rule, is that a sick person, who. perhaps, is in a very low state, is placed on the ground, in a dark corner of a tiny room, which room often has only one small door and no window. Several of his relations crowd round and deprive him of the small quantity of air present. The patient's personal cleanliness is scarcely ever attended to, and around him on all sides squalor prevails. The food he is furnished with is often of the most unsuitable nature, and as for medical treatment, he rarely gets any but that of a bazaar quack, who is ignorant of the uses of medicines and of the nature of disease processes. All this leads us to consider that when poor men or women get ill, they should go to a public hospital (if one is at hand) for treatment; by doing this they give themselves the best chance of speedy recovery. It sometimes happens, however, that no such hospital is available.

SURROUNDINGS OF SICK PERSONS.—Under these circumstances, the following directions for keeping the surroundings of the sick person in a suitable state ought to be followed :—

The *room* in which the patient is placed should be the brightest and most cheerful in the house.

The *air* of the sick room should be kept as pure as possible. Sick people give off a great deal of putrid matter from their bodies. They need twice as much air as the healthy. Windows and doors should be kept open, unless the weather is very cold; and even then they should not be altogether closed, for the patient can be kept warm by extra blankets. Care should be taken that no direct draught reaches the patient.

The *patient should be kept perfectly clean* by washing his hands and face, and sponging his body, at least once a day. He should be kept in *clean clothes.*

All *discharges* from the patient, and all soiled clothes, should be at once disinfected and removed from the room.

The patient should not be kept lying on the ground; a charpoy or bedstead of some kind should be provided for him.

All unnecessary *noise should be avoided*, for it disturbs the patient's rest. Do not make a fuss near the patient's bed, or in the room.

Do not keep bottles of medicine, or food of any description, about the patient, and never let drinking-water stand in the room.

If we can afford it, we should send for a qualified doctor and *obey his directions strictly*; we should never give any quack medicines, nor listen to the suggestions of friends about the treatment of the patient.

FOOD OF THE SICK.—In sickness, the first thing we frequently hear from patients is that they cannot take their food. Now, this is Nature's indication that, either the body does not want food or that it is unable to use it. Loss of appetite is a symptom of nearly all diseases; a good appetite, with few exceptions, is, on the other hand, a sign of health. In nearly all diseases, and especially acute diseases, it is wise to abstain from solid food, and even liquid nourishment need not be taken in too great quantities. In no case is the ordinary diet to be followed, or if followed, it should be lessened. This does not hold good for long-continued fevers, or in patients who are ill for some time; such cases require plenty of light nourishing food, as *milk*, *kheer*,* and, if allowed by caste, eggs and *soups*.

If a patient is very ill he may require to be fed frequently with small quantities of liquid nourishment. In long-standing complaints, especially fevers, it becomes necessary to keep up the strength. It is then often a question whether we should give some wine or spirits to the patient. This should never be done unless ordered by a doctor.

If the patient is weak, do not let him sit up to eat or drink, but feed him with a cup having a spout (a feeding cup), or with a curved glass tube.† Do not be constantly urging the patient to take food.

Sick people are often cross and apparently ill-tempered. This is, as a rule, not their fault; it is the effect of the disease from which they are suffering; we should be kind and enduring with them.

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* Boiled rice and milk sweetened with sugar.

† Syphon tube.

Rest and sleep are great restorers in sickness; therefore, do not wake up patients unnecessarily, that is, unless it is time for their medicines or food, and even then, in urgent cases only should the patient be roused: allow him to sleep as long as he chooses.

Be cheerful with the sick, and use as mild a manner as possible with them. All these apparent trifles go a long way to make patients comfortable and happy, and have no small a share in bringing about recovery.

COMMON INDIAN DISEASES.—We will now attempt to give a brief description of some of the more common diseases in India, with their treatment, and make a few remarks about common accidents that require immediate aid.

AGUE, INTERMITTENT FEVER, OR "THUP," is caused by the *Malarial Poison.** It is the most frequent disease met with in India. It may come on daily, or every second or third day.

Each attack is marked by three stages—the *cold*, *hot*, and the *sweating*.

The *cold* stage begins by the patient feeling languid and depressed. There are pains in the back and limbs, and a general sensation of chilliness which increases until shivering takes place; the lips and nails become blue, and the teeth chatter; there is much thirst, and vomiting may occur. This is followed in, from half an hour to two or three hours, by a feeling of heat. The skin is then dry, the face flushed, the *pulse*[*] full and hard, and there is headache and restlessness. Finally, the *sweating stage* comes on. A little moisture first appears on the forehead and face, which soon extends to the body and limbs, and then the clothes become saturated with perspiration. The patient now feels relieved from his sufferings.

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* *Malarial Poison* is generated under certain complex conditions of the air and soil. It appears to be an organic poison (probably an organic germ), which is brought into activity when the soil is moist, contains organic matter, and the air s warm.

Treatment.—In the *cold stage* put the patient to bed and cover him with blankets. If he is feeling sick, it may be well to give him an emetic of warm water; this tends to lessen the duration of the cold stage. In the *hot stage*, decrease the bed clothes covering him, and give him cold and acid drinks—lemonade, tamarind water, &c. About thirty grains of *nitre*[†] may with advantage be added to these fluids.

During the third stage no medicine is required. Cover the patient up to encourage sweating, and be careful to prevent a chill, which would stop the perspiration. Change the damp clothes and put on flannels.

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[*] The *pulse* is a movement of the blood vessels, produced by the alternate dilatation, relaxation, or contraction of the arteries arising from the push given to the blood by the action of the heart. In health there are in the adult about 75 pulse-beats per minute. The pulse on the outer and front part of the wrist is the one usually felt by the physicians; it is part of the radial artery.

[†] *Nitre*, saltpetre, or *naushader*. It is a salt called by chemists Nitrate of Potash. It is found as an incrustation on the soil in various parts of India.

The *interval* between the attacks is the time we have to prevent their *recurrence.*[*] For this we have only one reliable remedy—*Quinine.* An adult should take at least twenty grains of this daily—two ten-grain doses—before the hour at which the ague comes on; if this fails, thirty grains should be taken. To children smaller doses should be given—a grain for every year of age, split up into two or three doses administered during the day. Keep the bowels open, for if *constipation*[†] exists, quinine acts at a disadvantage; much of it, in fact, is then not absorbed.

PRECAUTIONS AGAINST MALARIAL POISON.—Always wear flannel next the skin. Avoid all possible causes of chills. If living in a malarial area, take five grains of quinine every morning. Always take some solid food and some hot tea or coffee before going out in the morning. Malarial poison is more active before sunrise and after sunset than during the day; if possible, therefore, avoid being exposed to it at those particular periods.

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[*] Ague is liable to come on every day, or every second, or third day, for a considerable period, and if its recurrence cannot be stopped by the free use of quinine, the patient should leave the malarial district for a time.

[†] *Constipation* is a condition associated with undue retention of fæces. Its immediate effects are defective appetite, coated tongue, disagreeable taste in the mouth, dulness, headache, and *irritability.* It may bring on dyspepsia (or indigestion), colic, and hæmorrhoids (piles). In most cases it is caused by indigestible food, astringent and stimulating drinks, sedentary habits, from want of exercise, excessive indulgence in sleep, &c. The immediate use of purgatives followed by strict attention to diet, proper exercise, and careful mode of living, are all that are in most cases required to remove it.

CHICKEN-POX.—This disease is almost peculiar to children. It is a very simple affection, and its only importance rests in the fact that it may be mistaken for small-pox. Sometimes, indeed, it is not altogether easy to distinguish the mildest form of small-pox from it. In chicken-pox there is a slight degree of fever, headache, and occasionally sore throat, with a vesicular eruption all over the body. The eruption comes out on the second day of the fever, and disappears about the fifth. It has the appearance that would be produced by a shower-bath of very hot water.

This disease rarely requires any treatment beyond a dose of castor oil, or a little rhubarb and magnesia,* to keep the bowels open.

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* Gregory's Powder.

CHAPTER II.

CHOLERA: ITS PREVENTION AND TREATMENT.

PERHAPS, the most impressive way of dealing with the subject of cholera, is to give the main facts in connection with it in a tabulated form.

1. Cholera prevails endemically in several of the large towns of India, as Hyderabad, Calcutta, Benares, and Lahore.

2. Cleanliness of every description is the greatest safeguard against the disease.

3. Every person in a community can do something to prevent its spread, and to banish it from its midst. If each person keeps *his* house, air, and water-supply pure, he prevents the disease attacking himself and his family, and lessens the chances of its attacking others.

4. Cholera is a very fatal disease. About one-half of those attacked die. By attending to the following directions we render ourselves as safe as possible against it.

5. Cholera is mainly produced by drinking polluted water.

6. *Boiling and Filtering Water* is the safest way

to destroy any poison it may contain. During cholera periods, if we are not certain as to the purity of water, it is dangerous to use it, if it has not been subjected to these processes. If we have no filter in our house, we should buy one, or construct one similar to that described at pages 72-74.

7. *Cholera is chiefly curable in the first stage, or that of Premonitory Diarrhœa.* The power of medicine to cure after this stage is past is very meagre. It is, therefore, absolutely necessary that the patient should be treated by a medical man as soon as the premonitory diarrhœa commences.

8. There is no way of distinguishing ordinary simple diarrhœa from this premonitory relaxation of bowels in cholera. Although they are distinct diseases, the existence of the looseness of the bowels at a season when cholera prevails *predisposes* to the latter disease. *The slightest attack of diarrhœa in any form should be attended to at once.* We should always have in our house a few of the medicines recommended in the next paragraph.

9. Every householder who can afford it should have a small bottle of *Laudanum** or *Chlorodyne*† in the house, and as soon as diarrhœa is manifested in any adult member of the household, 40 to 60 drops, or about a salt-spoonful of one or other of these medicines, should be given. In the case of

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* The other name for *Tincture of Opium.*

† A preparation containing Morphine, Indian Hemp, Capsicum, Treacle, Prussic (or hydrocyanic) Acid, and Oil of Peppermint.

children, one drop should be given for every year of age; in them more caution is required in the use of laudanum and chlorodyne. If the first dose is vomited, repeat it at once, and put a large mustard plaster on the abdomen (protecting the skin, in children, with thin muslin). The above remarks apply to all cases of diarrhœa occurring during cholera seasons. If the patient now commences to suffer from cramps in the abdomen and legs, from repeated vomiting, and the stools are like rice-water, we have to deal with a case of true cholera which is passing into the *second stage* or that of collapse. No laudanum or chlorodyne must now be given. The vomiting may be checked by giving pieces of ice to suck, and the thirst assuaged by iced water or soda-water. The cramps are relieved by rubbing the limbs with powdered ginger or turpentine. We should also use *hot water bottles* to the extremities and abdomen, to keep up the body warmth. From the first appearance of the disease the patient should take to his bed, and remain lying down until he is well. He should get no solid food. By following these directions we do not obviate the necessity of having a medical man in attendance; they simply guide us as to what should be done until the doctor arrives.

10. During cholera seasons no person should take purgative medicines unless prescribed by a medical man.

11. We should avoid all chills and checking of perspiration; we should wear a flannel shirt, and

also a flannel belt, to prevent catching cold in the bowels.

12. We should live regularly and temperately, and use our accustomed diet. Stale, unripe, or unsound fruit or vegetables, should on no account be eaten. Ripe fruit can do no harm, nor can *properly-cooked fresh vegetables.* We should avoid all tainted fish and meat; they are very dangerous. We should *not eat stale rice.* Care should be taken that children do not get *sour milk*; it is a frequent cause of diarrhœa in them. All milk consumed should be pure; *gowlies* frequently water the milk, and the water used for this purpose is often very impure. As a safeguard, it is wise to *boil the milk.* If you cannot get pure milk, use *condensed milk* instead. when cholera is about.

13. Drunkenness invites attacks of cholera. Temperance in drinking and eating are advisable.

14. It is very important to avoid all *foul smells,* especially those of privies, drains, filthy soil, and dust-bins. We should, therefore, see that our latrines, drains, and the ground around our houses, are kept thoroughly clean. We should disinfect the privy and drains three or four times a day with *phenyle* or some other powerful disinfectant. No *refuse* should be allowed to be in our compound or inside our house; it should be deposited in the dust-bin. *Burn* all *dry refuse.* All slops and liquid refuse should be thrown into the public drain, and abundance of water poured in after it, to flush the drain and keep it clean.

15. The *air* in and around our houses should be

pure. The best way to secure pure air is to keep our doors and windows open.

16. If we cannot make proper and efficient arrangements at home for the treatment of any of our relations, friends, or servants attacked with cholera, we should send them to a public hospital. By so doing we give them the best chance of recovering; they will there be well nursed and treated. Further, by so doing, we help to prevent the spread of the disease to the other members of the family, and lessen the chances of its extending in the community. Poor people cannot look after cholera patients properly; such cases require skilled medical aid and good nursing.

17. We should particularly remember that the *poison of the disease is contained in the vomited and purged matters*. These must, therefore, be thoroughly disinfected and got rid of at once. We should make the patient pass them into a vessel containing phenyle or other disinfectant. The vessel and its contents should then be placed under cover in an unfrequented part of our compound, ready for removal when the scavenger arrives.

18. All infected clothes, bedding, and utensils should be thoroughly disinfected with Phenyle or Condy's Fluid. It is safest, however, to *burn such clothes* and to break all chatties used, putting the pieces in a fire to prevent further infection or contamination. Some metal utensils may be readily purified by heating them over a fire.

19. All houses in which a case of cholera has taken

place should, after its termination, be thoroughly fumigated with *sulphur* and disinfected with some powerful germicide.*

20. If cholera breaks out in a house, all the unaffected children should be *at once* sent to some other dwelling place. Children are very susceptible to the disease, and in them it is very fatal. Only those adults should remain with the case who are necessary for nursing. *The patient should be kept in a separate room.*

21. Cholera is not ordinarily contagious, but it sometimes acquires the qualities of a contagious disease, especially when the poison is in a concentrated form, and when certain conditions of weather favour its development. The surest way to prevent its affecting us under these circumstances is by means of *good ventilation.* We cannot get too much air; the more air allowed into the room, the more dilute is the poison, and the less power it has to affect us.

22. Persons in attendance on cholera cases should always wash their hands and face before taking any food or drink. They should not eat in the room occupied by the patient.

23. We should not be afraid of cholera, nor make it a subject of conversation: fear and mental emotions depress the system and predispose to the disease. If we use pure water, breathe freely of pure air, keep our privies and drains clean, we are well defended against this disease.

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* *Germicides* are agents which cause the death of germs.

CHAPTER III.

DIARRHŒA AND DYSENTERY.

DIARRHŒA is a very common disease in India, and is characterised by the occurrence of more frequent and thinner evacuations from the bowels than occur naturally. It is important to know that diarrhœa is usually one of the first indications of cholera; it may also occur during many other diseases.

Diarrhœa is caused in a large number of cases by errors in diet. Eating too much food, unwholesome food, or certain articles which disagree may cause it. Not unfrequently it is produced by exposure to cold, checking perspiration, keeping on wet clothes, drinking cold or acid liquors, or taking ice when the body is overheated. In India, it is often due to malaria.

Symptoms.—Diarrhœa is usually accompanied by flatulency and slight distension of the abdomen, griping of the bowels, and sometimes sickness of the stomach. The patient feels relieved after such evacuation, which is voided without any straining. The number of stools vary from four or six to twenty in the day.

Treatment.—The first thing is to ascertain the cause of the diarrhœa. If it arises from over-eating, from partaking of unwholesome food, or from constipation, it is then an effort of Nature to expel the offending matter, and ought not to be checked abruptly by astringent medicines. In such cases it would be well to begin with a mild dose of castor-oil or Gregory's Powder,* to which in adults 10 or 15 drops of laudanum may be added. In all other cases than those enumerated, we should give some astringent mixture at once, and of these the most harmless and popular is chalk mixture combined with half a teaspoonful each of tincture of catechu and kino, and 10 drops of laudanum to each dose in the case of adults. In children, however, opium in any form requires the greatest care in its administration, and should never be given unless prescribed by a doctor, and an infant should never be given more than one drop for a dose.

The *diet* of the patient should be bland. Rice, sago, arrowroot, or bread and milk are best. The patient should remain lying down while suffering from the disease, and his belly should be covered with a broad flannel belt.

DYSENTERY.—Dysentery is a very common disease in India: it is said to be chiefly of malarial origin, but it may be produced by other causes, such as exposure to cold and wet; lying on damp ground, particularly after fatigue; wearing damp clothes, by scanty and unwholesome food and drink; eating unripe and sour fruit; drinking water rendered impure by organic matter; by the foul smells given off by badly kept privies, cess-pools, *sundasses*, and drains containing putrefying organic matters.

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* This is also called Compound Rhubarb Powder, and consists of rhubarb, magnesia, and ginger.

Symptoms.—The disease commences with griping pains of the abdomen and frequent calls to stool, with great straining and a burning sensation in the lower part of the bowel, and about its outlet. The stools at first contain some semi-liquid *fæculent** matter, but they soon become scanty, and then consist chiefly of jelly-like material called mucus† mixed with blood; there is pain in the abdomen, particularly on a pressure low down on the left side: the disease is usually accompanied with slight fever.

Treatment.—The patient must be put to bed and kept there until he has recovered. At first, a small dose of castor-oil may be given with fifteen drops of laudanum in the case of adults, or one drop for every year of age, in the case of children. In an adult, about two hours after this, a mustard plaster should be put on the pit of the stomach, and another 15 or 20 drops of laudanum administered. In another half hour, twenty grains of ipecacuanha powder (made into a paste, with syrup or honey, or into pills) are to be given. The patient should be told to endeavour to retain the ipecacuanha, as it is liable to make him sick. He should lie quietly on his back and try to go to sleep. He should not be given food of any description for two hours before and for two hours after the ipecacuanha. The latter may be repeated the last thing before going to sleep.

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* *Fæculent*, similar to fæces.

† *Mucus* is a viscid animal fluid secreted by the mucous membranes, and is best exemplified by that from the mucous membranes of the nose and bronchial tubes. It covers the mucous membranes, and serves to moisten and defend them.

This is the most successful plan of treatment for ordinary dysentery; it cuts the disease short, and prevents the occurrence of other diseases that are likely to arise in the course of this complaint. For infants and children, small doses of ipecacuanha, proportionate to age, may be given; for instance, one grain for an infant a year old, and five grains for a child eight years of age.

In the milder forms of the disease, it may sometimes be thought advisable to administer small doses of *Dover's powder** and bismuth (five or eight grains each) three times a day, or lead and opium pill (five grains) every four or six hours.

It should be remembered that dysentery is apt to become chronic, and that chronic dysentery is one of the most intractable diseases to treat.

Throughout an acute attack of dysentery, the diet should consist of milk, with some arrowroot, sago, or other simple farinaceous food.

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* *Dover's powder* is a preparation containing *opium*, *sulphate of potash*, and *ipecacuanha*.

CHAPTER IV.

FAINTING, FITS, SMALL-POX AND VACCINATION.

FAINTING most frequently occurs in delicate women or girls, and in close heated rooms or after unusual exertion. In the ordinary faint, the patient becomes unconscious for a few moments. The first thing to be done is to lay the patient flat on the back, keeping the head low, and convey her to the open air. All tight articles of dress about the abdomen, chest, and neck should be removed. Smelling-salts or hartshorn may be applied to the nostrils, and a little cold water may be sprinkled on the face or upper part of the chest.

On the return of consciousness, give a small quantity of any stimulant at hand—a dessert-spoonful of brandy well diluted, for example. A tea-spoonful of *sal volatile*,* in a wine-glassful of water, is an excellent restorative in these cases.

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* *Ammonia* is an alkaline substance which differs from other alkalies in being gaseous, hence often called the volatile alkali. It is a colourless, pungent gas, composed of nitrogen and hydrogen. It irritates the air-passages, and is the active agent in sal volatile.

FITS.—Fits are usually the result of *epilepsy*,[*] in which the patient falls to the ground, becomes insensible, and is seized with *convulsions*.[†]

In such cases, lay the patient on his back, loosen all constrictions around his neck, chest, and abdomen, especially collars and cravats; prevent him from injuring himself in his convulsive movements. and be careful that he does not bite his tongue. This latter may be effected by placing the handle of a spoon or a piece of wood covered with a rag or a strip of a handkerchief, between the teeth, by dashing some cold water on his face, and applying smelling salts or *ammonia* to the nostrils. If these means fail to restore consciousness, medical advice must at once be sought. It is very wrong to give stimulating liquors, for, indiscriminately used in such cases, they are positively dangerous to life. Sometimes "fits" are produced by the rupture of a blood vessel in the brain, and in such cases the administration of alcoholic liquors would increase the quantity of blood flowing from the lacerated vessel. Under no circumstances, then, unless prescribed by a doctor, should alcoholic stimulants be given in case of fits.

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[*] *Epilepsy* is a disease of the nervous system associated with fits, in which the patient falls suddenly, hence called falling sickness. In its fully-developed form, convulsions, attended by complete unconsciousness, is the prominent feature. During the paroxysm, to prevent the patient from injuring himself, raise the head gently, loose all constrictions, and protect the tongue by placing a piece of cork, india-rubber, or soft wood between the teeth.

[†] *Convulsions* is a morbid state in which there are violent and involuntary contractions of the muscles with alternative relaxations; they may be confined to some part or limbs, or affect the whole body. Children are often the subjects of convulsions, during dentition particularly, when the process is caused by a disordered state of the bowels or by the presence of worms.

SMALL-POX.—No disease is so preventable as small-pox. This very preventability is one of the greatest triumphs of the medical art. There are now many instances in which it has been almost entirely stamped out in large communities, by vaccination properly carried out.

Small-pox is almost always present in some part of India. It is worshipped in the form of a goddess by certain classes of Hindoos. *Inoculation** for this affection has been carried on for two thousand years. Wherever small-pox occurs and vaccination is not practised, the disease becomes a most loathsome and fatal scourge. It is the most contagious and infectious disease known. It may be said that its existence, to any extent, in a civilised nation, is a *stigma*† upon that nation.

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* *Inoculation* is the term given to the insertion of any infectious or poisonous matter. Here it refers to the introduction into the skin of the small-pox poison directly, with the view to the production of small-pox in the person inoculated.

† Blemish.

Small-pox appears about twelve days after the patient has been exposed to the poison. At its commencement he complains of severe backache, headache, vomiting, and after two days of fever, small, hard, red *pimples* appear on the face, forehead, and wrists, and then on the limbs and body. There is usually sore throat, and similar pimples occur in the throat and mouth. When the pimples come out the fever abates. The pimples in a few days become little vesicles, and about the eighth or ninth day have changed into *pustules*. When this occurs the fever increases again, the face becomes swollen, and the soreness of throat becomes worse. The eyes may be affected and dangerously *ulcerated*.[*]

There are several varieties of small-pox—*discrete*, in which the vesicles remain separate on the face; *confluent*, in which they run into one another; *semi-confluent*, midway between these two; and *hæmorrhagic* (the most dangerous form), in which the vesicles, or what would have been vesicles, are filled with blood.

It would be difficult to describe the terrible effects of small-pox as it occurred in Europe two hundred years ago; old and young, rich and poor, were equally attacked. The people of entire villages have been removed by it. In the Deccan, almost every third or fourth person one sees is pock-marked: many have lost their eye-sight from its effects. These people so affected are the survivors only.

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[*] *Ulcer* is a solution of continuity or breach of the surface in any of the soft parts of the body, usually attended with the formation of pus or some other discharge.

Treatment.—Every case of small-pox should be *isolated** as far as possible. Nothing short of the most thorough system of vaccination, carried to the houses of the people, can stamp out small-pox. Such vaccination should be made compulsory throughout the country.

If small-pox appears in the house, we should write to the sanitary authorities of our town (or municipality) about it at once. In the case of paupers, the municipal authorities should make arrangements for the treatment of the patients attacked. If necessary, the sanitary authorities will get all our relations vaccinated. The duration of small-pox, like that of other specific infectious diseases, cannot be cut short; it will run its course, but we can do much to guide that course. Nursing is more important than medicines. During the entire attack the patient should be given iced and acid drinks, lemonade, tamarind water, and the like; he should be frequently sponged all over with tepid water and kept in clean clothes. If he is very weak a little brandy or whisky, well diluted, may be given.

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* *Isolated* is the setting apart or the segregation of the sick. It is one of the methods of preventing the spread of disease known to be infectious.

If the vomiting is severe, he should be supplied with small bits of ice, or iced soda-water in small quantities. Liquid and nourishing food should be given in small quantities frequently. If the bowels are constipated, a few grains of calomel, or a dose of castor-oil, may be administered.

The pustules should be covered with *carbolic oil* (1 part of the acid to 100 parts of some bland oil); this relieves the pain and prevents the particles of matter floating into the air; *collodion** is sometimes more agreeable.

To prevent *pitting*, a little *blue ointment*† may be applied, or small quantities of very dilute oleate‡ of mercury may be used in the same way. A very simple and excellent method is to open the pustules, squeeze out the matter, and then wash the part with tepid milk.

Some people prefer *cauterising*§ the bottom of the pustules with lunar caustic‖, but we do not recommend this. In all cases it is advisable to seek the advice of a doctor.

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* *Collodion* is a solution of gun-cotton in ether.

† *Blue Ointment* consists of mercury mixed with some sort of fat.

‡ *Oleate of Mercury* is a special preparation of mercury, consisting of oleac acid combined with oxide of mercury.

§ *Cauterising* means the searing or burning of living flesh by a caustic solution or actual cautery.

‖ *Lunar* is the name given to nitrate of silver when cast into sticks for the use of surgeons, &c.

VACCINATION.—The little operation of vaccination is carried out by implanting on the abraded skin of the arm or elsewhere, the vaccine lymph taken either from a vaccine *vesicle** on the udder of a calf (*animal vaccination*†), or by similar lymph taken from the arm of a recently-vaccinated person (*arm-to-arm vaccination*). By this process the vaccinated person is to a considerable extent protected against small-pox. The essence of the protective influence of vaccination rests in the fact that *the small-pox poison, in passing through the system of the calf or cow, is deprived of its virulence*‡.

Vaccination produces a simple disease called *cowpox*, and in doing so it prevents, to a great degree, the possibility of the occurrence of small-pox.

In the human body there is a material on which the cow-pox and small-pox poisons feed and multiply. This food is in a limited quantity, and when eaten up is not reformed, or is reformed only at long intervals. By vaccination, the cow-pox germs (?) consume all this food, leaving none for the small-pox germs to live on; so that if a vaccinated person is brought into contact with a case of small-pox, the germs of the latter alight on a barren soil; there is no food on which small-pox poison might live. After some years, however, it is said that this food may be once more generated in our bodies; *re*-vaccination is then necessary, and it should be carried out systematically in children about twelve years of age.

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* *Vesicle* is a small cavity or sac containing serous fluid. A serous fluid is one like the watery portion of the blood.

† *Animal Vaccination* is the inoculation with the cow-pox matter by the vaccine lymph obtained from the cow, and intended to act as a preventive against small-pox.

‡ *Virulence.*—Malignant or poisonous properties.

Every infant should be vaccinated before it attains the age of three months, unless there is some important reason for not doing so.

Vaccination is a simple and harmless operation when properly done. If it were efficiently carried out it would exterminate small-pox from civilised communities.

CHAPTER V.

INJURIES AND ACCIDENTS.

Abscesses—Bites of Animals—Bleeding—Bruises—Burns and Scalds—Drowning—Concussion of the Brain—Fractures—Snake-bites—Sprains—Stings—Poisoning—Swallowing Foreign Bodies—Foreign Bodies in the Throat—Foreign Bodies in the Air-passages—Foreign Bodies in the Ear—Wounds—Incised or clean cut wounds—Bleeding—Lacerated or Torn wounds—Punctured wounds.

ABSCESSES are among the most frequent forms of minor complaints met with in India. They are collections of "matter," or pus, in some tissue or organ of the body, and may be acute or chronic. We shall here refer only to those that occur immediately beneath the skin, and are of rapid formation.

Abscesses are always preceded by inflammation, which is marked by the occurrence of heat, redness, swelling, and pain on the part affected. When *pus** has formed, the pain takes on a throbbing character, and from being sharp, becomes dull: the skin shines, and by placing the fingers of the two hands flat on the surface of the part and keeping those of one hand steady and pressing both those of the other, the sensation of a moving liquid is given to the fixed fingers; this is called *fluctuation* by surgeons. If the abscess is at all large, the production of matter is accompanied with shivering fits, followed by fever. If the abscess is not deep, the matter tends to make its way to the surface or to "point," and if it is not let out by surgical means, the skin of the part becomes thinner, and at last gives way, the matter being discharged. If an abscess goes through these regular stages, it may be left to burst of itself. For all other forms of abscess than this superficial kind, a doctor should be at once consulted.

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* *Pus* is the yellowish semi-liquid material that exudes from an abscess when it is opened, or from an ulcer. It consists chiefly of small round cells floating in a clear fluid, the cells giving it its yellow color.

Treatment.—When inflammation occurs, we must attempt to prevent the formation of pus by means of a light diet, keeping the bowels open, and the application of cold water or lead lotion. If pus has formed, or is about to form, nothing is better and more soothing than a large linseed meal poultice, changed at least every two or three hours. If the abscess is slow in bursting, it should be opened with a lancet or sharp penknife.

BITES OF ANIMALS.—The teeth of such animals as *dogs* and *cats* may tear, bruise, or puncture the part that is bitten, or they may merely graze the skin. The treatment of the wound will vary with the nature of the bite. Usually, all that is necessary is to suck the wound, apply some caustic, or *nitric acid*,* and dress it with a piece of clean rag or lint, or a bit of a handkerchief that has been soaked in cold water, keeping the rag constantly wet. If there be much pain, hot fomentations* or a poultice give relief.

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* *Nitric Acid* is a compound of a O and N united ordinarily with water, when it is called *aqua fortis*. It is very corrosive, and produces sores when brought into contact with the animal body.

Much error prevails regarding the relation between hydrophobia and dog bites. Now, a dog *is* or *is not mad.* If it is not mad, there is no possible fear of hydrophobia following a bite inflicted by it. Madness in dogs shows itself in two forms—(1), *Raving Madness* and (2), *Dumb Madness.*

Raving madness is recognised by a change in the demeanour of the dog; it becomes morose, depressed, wanders about, and desires to hide itself. It gnaws at objects coming in its way, snarls and snaps, and becomes very excited if at all frightened; is frequently seen pawing its throat, foams at the mouth, and in barking makes a peculiar harsh noise. The dog will bite its master and animals of any kind, but is more inclined to attack other dogs. Healthy dogs endeavour to get out of its way, even during the early stage of the disease. There is *no* dread of water. Before the commencement of the disease, the animal is sometimes unusually affectionate to its owner. Raving madness is the usual form of canine rabies. In the other form of the disease—*dumb madness*—the muscles of the lower jaw bone are paralysed,† therefore the animal cannot bite. The hind limbs are also often paralysed. The disease may occur in dogs of all ages, and at any season of the year.

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* Hot fomentations are applied by soaking a piece of flannel in hot water and ringing it out, and then applying it to the part affected.

† A part is said to be paralysed when it has lost the powers of voluntary muscular motion. There are different forms of paralysis; there may be loss of power of motion, or of sensation, or both.

Any dog showing a marked tendency to bite other animals should be at once muzzled and chained up. It is unwise to have a suspected animal killed at once; it should be shown to some doctor or veterinary authority, who will decide whether the dog is rabid or not.

We ought never to encourage our dogs to lick the hands and face, especially if there are any abrasions, scratches, or wounds on them.

BLEEDING.—Bleeding from simple wounds is usually not dangerous; it may be stopped by *pressure*, and the *application of cold water or ice* to the part affected. Occasionally, however, it is necessary to apply *astringent medicines* or a *ligature*. As a rule, the bleeding ceases when the edges of the wound are brought together, and the part bound up moderately tightly. If there is still a little discharge of blood, it may readily be stopped by the application of ice or cold water.

Wound of an Artery.—We recognise that an artery is wounded by the blood having a bright red or scarlet color, and by its spouting out in jets from the wound.

The treatment here is to at once press with the point of the *clean* finger on the spot from which the blood appears to flow, and keep it there until the dressings for the wound are ready. These dressings consist of a hard pad, made by rolling a piece of clean rag or lint round a smooth stone, a coin, marble or shell (cowrie), &c., applying this pad to the part on which the finger was placed, and keeping it there by means of a bandage tied pretty firmly. Cold water may then be applied. Should the amount of blood issuing from the wound be large, it will be necessary to send for a doctor, but in the meantime a ligature should be tied around the limb, above the wound, that is, between the wound and the heart, keeping the pad firmly bound to the wound at the same time. The ligature may at first consist of a handkerchief tied tolerably firmly around the limb, but if this does not stop the bleeding the following plan is recommended:—Tie two diagonal corners of a handkerchief into a knot, and pass the loop of the handkerchief over the limb, above the wound; now pass a stick through the loop and twist the stick round and round, until the ligature is tight enough to stop the bleeding. Remember that this is but a temporary measnre, and that prolonged constriction of this nature is very dangerous, as it may lead to mortification* of the part below the ligature.

Bleeding from a Vein.—The blood flowing from a wounded vein is of dark red colour and discharges in a *continous* stream. For its *treatment*, usually, all that is necessary is to apply a clean, firm pad over the wound, keeping it there with a bandage tied tolerably firmly. If this proves of no avail, apply a ligature below *and* above the seat of the wound.

Remember that the blood in the arteries of the limbs flows towards the tips of the fingers and toes from the heart, and that the blood in the veins of the limbs flows from the fingers and toes towards the heart; but owing to the existence of little valves in the veins, the blood current may for a short distance be reversed, hence the use of the ligature above the wound. When blood *oozes* from a wound, it is usually due to rupture or division of the minute blood vessels. called *capillaries;* such bleeding requires merely a pad, cold water, and bandage applied to the wounded part.

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* *Mortification* is the death of one part of the body while the other is alive. It is called *gangrene* when it occurs in soft or fleshy parts.

Bleeding from the Nose.—This is, as a rule, slight, devoid of danger, and often does good to the patient; it is injurious only when much blood is lost, or when it recurs frequently, and is long continued. As a rule, nothing need be done, but if the face is at all pale, or the patient feels faint and giddy, or sick at stomach, we must attempt to arrest the bleeding. This may be done by exposing the patient to cold air, keeping his head erect, and applying ice or cold water to the face, nose, and back of the neck. Do not give the patient stimulants. If it still continues, place the feet and hands in hot water and mustard, and send for a doctor, who will, perhaps, plug up the nostrils and administer some internal medicines.

BRUISES.—Bruises are injuries caused by such violence as falls, blows, wrenches, &c. They may be severe or slight. In them the skin is not damaged, but the soft tissues beneath it are torn. The tiny blood vessels ruptured, the blood escapes, and causes swelling and discoloration of the bruised part. The colour of the injured part at first is usually purple, and then passes to green and yellow.

Treatment.—If the bruise is slight, all that is necessary is to apply a cold, wet cloth, or a piece of ice wrapped in cloth, and keep the part at rest; but if the injury is severe and the swelling has stopped increasing, hot fomentations or linseed meal poultices give much relief.

A simple bruised wound requires nothing more than the application of cold water and rest.

BURNS AND SCALDS.—A *burn* is an injury produced by the contact of dry heat with the body. Such injury may be caused by the flame of a lamp, candle, or fire, by burning clothes, hot metal, &c. A *scald* is a similar injury brought about by hot liquids. The effects in both are much the same, and vary with the length of time the damaged part is exposed to the heat. The *amount of danger* to the patient varies with the *extent* of the body involved, the *depth* to which the effects of the heat have penetrated, and the region of the body affected. For example, a slight or superficial burn of a large surface of the body is usually more dangerous than one of a more severe nature affecting a limited area. Burns are usually very painful at first. To remove the pain, the first thing to do is to smear some linseed or sweet-oil on the clothes, if they cover the injured part; next, carefully remove all clothing; this should be done with the utmost gentleness, and all clothing that is not readily removable should be cut off. To facilitate the removal, the oil may be passed between the skin and the clothes to soften them, and decrease the friction around, thus preventing the peeling off of the skin. If there are any raised blebs or blisters, prick the skin over them with a large, *clean* needle—a darning needle being best. Now soak some *cotton wool* in a mixture of equal parts of lime-water (*chunah-pani*) and sweet-oil,* and apply it to the part affected. If these are not at hand, a saturated† solution of bicarbonate of soda may be applied. Bandage the whole carefully and lightly, so as to exclude the air. In the absence of the above agents, *flour* may be dusted on the part, but it is to be avoided, if possible, as it cakes, and is difficult and painful of removal.

Now, cover the patient up with warm clothes, and keep him in a warm room. Give him a stimulant if depressed, and if the pain is severe, give an adult 20 drops of laudanum or chlorodyne in water.

Do not remove this first dressing until it becomes hard and stiff or irritating, or there are signs of "matter" having formed. In renewing the dressing, do not uncover all the burn at once if it is a large one, but dress it bit by bit.

As the clothes usually worn—and especially those worn by women and children—are of a very combustible nature, it occasionally happens that they catch fire. In case of such an accident the greatest presence of mind and coolness are needed. Air is necessary for combustion; therefore, if we can exclude it, the flames will be extinguished. This is best done by laying the patient on the ground and enveloping him or her in a blanket, carpet, coat, or any other large cloth at hand. Now keep pouring cold water over the half-burned clothes until they are cool, and carry the sufferer to a warm room, lay him on a table or floor, and with a scissors or sharp knife remove the clothes. The subsequent treatment is the same as that for burns already described. In case of such an accident as this, never allow the patient to run wildly about, as this merely serves to fan the flames.

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* *Sweet-oil.*—This name is often applied to all bland, unirritating oils, such as olive, linseed, and other oils.

† The word saturated means containing as much as the water or other fluid will dissolve.

DROWNING.—In drowning, the suffocation suffered is due to the prevention of entrance of air into the lungs. The water, in which the patient has been immersed, by filling the air-passages, prevents the air being inhaled as effectually as if he were strangled, or had a tight cord around his neck.

Treatment.—Send for a doctor at once, but in the meantime endeavour to restore the patient by the following means :—Loosen the clothes about the neck and chest, open the patient's mouth, draw out the tongue, remove all foreign bodies, saliva, &c., that may be in the mouth or nostrils. Get some clothes, make them into a bundle, turn the patient on his face, so that the " pit of the stomach " rests upon the top of the bundle. Now press the convexity of the back produced in this way, down to the bundle of clothes three or four times. Turn the patient again in such a way that the centre of the back rests on the bundle of clothes, and put some warm covering over the lower half of the body. Grasp the patient's arms above the elbow, and pull them upwards, until they meet above the head; this has the effect of causing the air to enter the lungs, and imitates natural inspiration. Next bring the arms back to the sides, and repeat this upward and downward movement about fifteen or sixteen times in a minute, and continue doing so until the patient breathes naturally, or all hopes of his recovery are gone. This is called *artificial respiration*, and we should remember that it has been successful after five hours apparently suspended animation. When breathing is properly established, cover the patient with warm clothes, particularly warm blankets, and rub his limbs upwards, that is, towards the heart. Apply hot bottles to his feet, legs, loins, armpits, and pit of the stomach, and a mustard plaster over his heart.

After respiration has been re-established, and power of swallowing restored, a little warm brandy and water or other stimulant well diluted should be given to the patient.

CONCUSSION OF THE BRAIN is usually due to blows on the head or to falls, or violent shock to the whole body. The patient lies insensible, the pulse is weak, the face pale, the limbs cold, the breathing hard, and the pupils are generally contracted.

In the treatment of a case like this, it is useful for us to know *what not to do*. Do not douche the patient with cold water or apply ice to the head; he is very much depressed already, and these agents would still further lower him. Do not pour any alcoholic liquor down his throat; a doctor may do this if he sees the necessity, but no one else should.

First, place the patient on his back, keeping his head low, covering him up with a blanket or great coat, carpet, or any other covering at hand. The hands, feet, and limbs may be gently rubbed *upwards*. He will recover consciousness, and will probably vomit or feel sick in a few minutes, if he is to get well quickly. This vomiting is a good sign. After this he may be carried in a lying-down position to his house. If unconsciousness continues, something serious has taken place, and a doctor must be consulted without delay.

FRACTURES.—Bones are liable to be broken by various forms of violence, and when broken are said to be *fractured*. The signs by which this accident are made known are,—unusual freedom of movement in the length of the limb, local swelling, depression or deformity, and a sensation of *grating*, caused by the broken ends of the bones coming into contact with one another. Fractures are said to be *simple* when there is no wound of the skin communicating with the broken parts of the bone. In *compound* fractures the broken bone is in communication with the external air.

Treatment.—The greatest possible care is to be taken to prevent a simple fracture becoming a compound one. This is best done by keeping the part in a state of absolute rest until treatment is begun. As soon as the accident takes place, the limb should be gently stretched, and if the patient is away from home, a splint should be made of a dozen straight bamboo twigs rolled up in pieces of cloth, straw, or grass. These should be placed around the limb, and fixed with two or three pocket-handkerchiefs or strips of cloth or a bandage. A *puggree* does very well for this. These temporary splints should be tied pretty firmly, but not so tightly as to stop the circulation in the limb, which would be a dangerous thing to do. The patient should then be carried home, or to a hospital, and a surgeon sent for. The above form of splint is specially mentioned, because it is most easily got the moment it is required. Pieces of wood, bamboo-matting, cardboard, small branches of trees, *lathis*, or other such articles are equally useful for the purpose. It is to be remembered that the above is a preliminary only, and serves to prevent any further damage to the part. The final "setting" is to be carried out at home or in an hospital. In the absence of a surgeon, this may be effected by placing the patient on a hard, level bed.

The previous fixtures are now to be removed. An assistant holds the limp above the point of fracture, whilst the operator gently, and slowly, but firmly, pulls from the lower end in a straight line in the natural direction of the limb, being careful to avoid all jerking. By these means the broken ends are brought together into their normal position. When this has been properly done both the limbs are of equal length. The limb is now to be fixed in this position by means of one, two, or three splints. These may be made of light, thin board, or gutta-percha, or cardboard, and should be thoroughly padded with cotton-wool on the inside, and particularly over parts that come into contact with bony prominences. The splint or splints should be about the same length as that of the broken bone. If it is thought necessary, a third splint may be applied for the limb to rest upon. The splints should be firmly bound by pieces of bandage or straps tied at intervals along the broken limb.

Care should be taken that they be not bound too tightly, for this would interfere with the circulation in the limb and the repair of the broken bone. As the parts about the broken ends of the bone swell during the first few days after the accident, the point of fracture is not to be bandaged too firmly. It would be better to leave it exposed to see how the union of the bones is going on. If the bone has been properly set, the splints carefully applied, and the limb kept at perfect rest, nothing more will be needed in the treatment. The straps or bandages, however, will require to be tightened every three or four days, but the splints ought not to be meddled with for about three weeks, unless some unusual occurrence demands their removal. If any inflammation arises, it may often be subdued by the application of *cold water** to the part.

There are many varieties of facture requiring special modes of treatment, which we cannot describe here. The directions given above are applicable to most forms of simple fractures of limbs, and can be carried out very readily. In all cases, when a surgeon is available, he should be asked to see and treat the fracture.

SNAKE-BITES. Bites are more frequently inflicted by harmless than by dangerous snakes. Most people, however, cannot distinguish the one kind of snake or its bite from the other; yet they are only too conscious of the terrible consequence of a bite inflicted by a poisonous snake. The result is that the bites of even innocent snakes are accompanied by much depression from fear.

The bite inflicted by a poisonous snake generally shows only two punctures, whereas those of harmless snakes show four or six.

Treatment.—Send for a doctor at once, but in the meantime the following aid should be afforded:—

Apply a ligature similar to that described to stop arterial bleeding (see page 264) a few inches above the place of the bite, and apply three or four more such ligatures above the first one, at intervals of a few inches. The part may now be sucked by the patient or by a by-stander. It must be remembered, however, that this is a dangerous thing to do, if there are any abrasions, ulcers, or wounds on the lips or mouth, and whenever it is done the operator should immediately afterwards rinse his mouth out with a solution of *Condy's Fluid*, or a powerful disinfectant lotion. After this has been done, incise the wounds by cutting across the punctures with a sharp penknife or other instrument, and allow the wound to bleed freely, or preferably, *excise* the punctured and poisoned parts to a depth of a quarter of an inch at least. Now apply either a hot iron or live coal, or some pure *nitric* or carbolic acid, to the bottom of these wounds as quickly as possible. Next give the patient, if an adult, 15 drops of solution of ammonia, or a teaspoonful of sal volatile, in a wineglassful of water. If he is much depressed and inclined to faint, give him an ounce of brandy or whisky, or rum well diluted.

---

* *Cold water dressing* consists merely of the application of a clean rag or bit of lint saturated with cold water, and kept on the part affected by a light bandage.

If the bite be on such a part that ligatures cannot be applied, the first thing to be done is to suck the wound thoroughly, pinch up the punctured places, and excise a circular piece as large as the thumb nail, from around each puncture to the depth of a quarter of an inch, and apply one of the cauterising agents above-mentioned.

Should no symptoms of poisoning come on, in half an hour remove the ligatures, or the part will mortify, from the stoppage of the circulation. But if depression, faintness, nausea, and quick breathing occur, the ligature should be kept on until the patient is recovering, or until the ligatured part is cold and livid.

Repeat the brandy or other stimulant at hand every quarter or half hour, according to the amount of depression, but do not intoxicate the patient. Apply a mustard plaster over the heart and to the calves of the legs.*

People travelling in the jungle should always take with them some Condy's Fluid or the crystals of *permanganate of potash*. It has been proved that this salt of potash renders the poison inert, and if it can be brought into contact with the poison in the bitten part early enough it is said that no symptoms of poisoning will ensue. If, however, a blood vessel has been penetrated by the poison fang, the poison is carried throughout the system almost at once, so that nothing can be of much avail.

No method of treatment of the bites of really venomous snakes (we refer especially to those of the *cobra* and *krait*) has hitherto proved satisfactory. The plan above sketched is based on the experience of one of the greatest living authorities on the subject. If the bite be that of a harmless snake, under this treatment the patient speedily recovers; if it be that of a poisonous reptile, no other mode of treatment is so efficacious.

---

* Abstracted from *Health in India*, by SIR JOSEPH FAYRER, M.D., F.R.S., &c.

We frequently hear of persons having discovered a cure for snake bites. Pay no attention to such assertions. If the advice given by quacks be followed to the exclusion of the plan of treatment we have recommended, the unfortunate patient will be deprived of the only chance he has of recovery.

SPRAINS.—These are injuries produced by falls, blows, twists, or wrenches of the joints, in which the ligaments* or tendons, or both, around the bones are torn or considerably stretched.

Sprains are often more painful, severe, and serious accidents than either *dislocations*† or *fractures*. The more serious forms of this injury, if not properly treated in the early stage, may cripple the patient for life. A sprain is recognized by the pain, swelling, and discoloration around the joint, coming on shortly after the accident.

Treatment.—The joint must be kept in a state of perfect rest. A bandage steeped in cold water may be applied around the joint pretty firmly, or if this gives pain, hot water may be used instead of cold water.

---

* *Ligaments* are the dense, fibrous structures which unite the bones entering into the formation of joints with one another.

† *Dissolution* is a surgical term applied to cases in which the articulating surfaces of bones have been forced out of their natural positions. The chief joints affected are the hip, shoulder, elbow, knee, ankle, and wrist. The chief obstacle to the bones resuming their natural positions is the contraction of the muscles around the joint, and considerable force (called *extension*) is sometimes necessary to effect this.

If the pain continues severe, relief may be obtained by the application of a hot linseed-meal, *atta*, or bread poultice, which should be changed frequently. When the swelling is decreasing some stimulating liniment* (the best being opodeldoc or soap liniment†) should be rubbed over the joint, and from this time onwards the joint should be carefully exercised. Avoid prolonged rest of the part, for this is frequently followed by permanent stiffness of the joint.

STINGS.—The stings of scorpions, bees, wasps, some varieties of mosquitoes, centipedes, and tarantulas, cause much pain for a time. The pain is due to the deposit of an acid called *formic acid* in the skin of the part stung. The *treatment*, therefore, aims at neutralising this acid by applying an alkali : of these the best is *hartshorn* or *liquid ammonia*. If these are not at hand, a saturated solution of washing or baking soda or of lime-water may be used. If none of these are to be had, a lather of soap, glycerine, or some bland oil may be applied. In the case of a wasp or bee sting, the sting itself must be removed, and it is a good plan after this to press the barrel of a key on to the part stung. In the adult, if the pain is severe, the hypodermic injection of $\frac{1}{4}$ grain of cocaine is strongly recommended by some authorities.

---

* A *liniment* is a semi-fluid ointment or soapy compound for rubbing on painful joints and other parts. But the term also includes spirituous applications employed externally.

† *Soap liniment* is prepared from soap, oil, and spirits, and is one of the most useful applications we possess for painful and stiff joints.

POISONING.—Poisons are occasionally swallowed by mistake. In the case of such an accident, the first thing to do is to try and make the patient sick, so as to bring back the poison. This may be effected by giving large draughts of warm water with a tea-spoonful of common salt, or with a dessert-spoonful of mustard, and then putting the fingers down the throat as far as possible. If the poison is of a dangerous nature, send for a doctor at once.

SWALLOWING FOREIGN BODIES.—Children frequently place marbles, coins, buttons, and other bodies, in the mouth, and sometimes swallow them accidentally. This need not alarm the parents, and, as a rule, nothing need be done for it. The foreign body will be passed from the bowels in due course. We would caution parents against the habit of giving purgatives in such cases; all they need do is to feed the child on a constipating diet, such as bread or rice and milk, for the ensuing twenty-four hours. The foreign body will by this means become impacted in, and carried along with, the solid fæces.

FOREIGN BODIES IN THE THROAT.—Foreign bodies, such as fish bones, large pieces of meat, husk of grain, and fruit stones, sometimes stick in the throat, or in the upper part of the food-pipe, and create much alarm, as they can neither be swallowed nor ejected.

The *treatment* here is to place the patient sitting on a chair with his face in a good light, open the mouth as widely as possible, and look down the throat for the offending body. If it can be seen and reached, the simplest way of getting rid of it is to hook the finger around and withdraw it. If it is a sharp-pointed body that has stuck in the mucous membrane, remove it with a forceps or pincers of some kind. If it cannot be seen, we should carefully attempt to hook the finger around and remove it or push it down the food-pipe. These means failing, make the patient swallow as large a piece of the crumb of bread as possible, or attempt to make him vomit by giving him an emetic of warm water and mustard, and tickling the back of the throat; sometimes a few slaps on the back will serve to dislodge it.

FOREIGN BODIES IN THE AIR-PASSAGES.—In swallowing rapidly, bits of food occasionally pass down the wrong way, that is, into the air-passages. This is a comparatively rare accident, as nature, by a beautiful contrivance, closes the larynx during the act of swallowing; but when it does occur it is always very alarming and frequently very dangerous. We know that this has occurred by the patient suffering from great difficulty of breathing, from a sense of suffocation, and from the severe cough that comes on every minute or so. If the foreign body completely obstructs the entrance of the air-passages, and is not dislodged, death may take place very suddenly.

Treatment.—The doctor must be sent for instantly. To save the patient's life and to allow him to breathe, it may be necessary to open the wind-pipe from without. In the meantime, we should invert the body, that is, cause the patient to stand, as it were, on his head. In the case of a child, this can easily be done, by laying it on a small table, grasping the feet, and tilting the table, until the head is nearly perpendicular to the ground. When in this position, give a few sharp slaps on the back. Should this fail, induce the patient to run twenty or thirty yards; this sometimes causes the foreign body to be coughed up. This also proving futile, try to make the patient vomit by tickling the throat. If unsuccessful, put the patient quietly to bed, and wait till the doctor arrives.

FOREIGN BODIES IN THE EAR.—Insects, peas, beans, stones of fruit, seeds, heads of matches, and such like things occasionally find their way into the ear. In the case of an insect, all that is necessary is to drop some bland oil into the ear, which either kills it, or stops it wandering about. Peas and the heads of matches may generally be removed by carefully syringing out the ear with warm water. Should this fail, a doctor must be consulted. On no account should the ear be tampered with: this caution is especially needed in the case of children, in whom the external ear passage is very short. We should be certain that we are dealing with the ear that is affected.

WOUNDS.—Wounds are usually classed as—(1) incised or clean cut wounds; (2) lacerated or torn wounds; and (3) punctured wounds.

INCISED OR CLEAN CUT WOUNDS—Are produced by sharp cutting instruments, such as a knife, penknife, or sword, &c. If large, they may bleed very freely, in which case the treatment suggested in the case of

BLEEDING should be employed. After staunching the hæmorrhage, the wound itself is to be thoroughly cleaned, by removing all foreign bodies, pieces of sand or gravel, or anything else that may have got into it. This is best effected by the use of a clean rag and a stream of cold water. It will be well to add some carbolic acid to the water, making this carbolic lotion 1 to 50 in strength. We next bring the edges of the wound together, which may best be done by long strips of sticking plaster. In applying the sticking plaster, first cause one end of it to adhere to one side of the wound, press the edges of the wound together between the finger and thumb, pull pretty firmly on the plaster, and fix it to the opposite side of the wound. If necessary, apply two or more strips of plaster in this way. The plaster should never completely encircle the limb, although it should be a little longer than half the circumference of the limb, and it should be about half an inch broad. If the wound is at all large and painful, apply a piece of lint over the strips of plaster, or a clean cotton cloth saturated with cold water.

LACERATED OR TORN WOUNDS.—As a rule, these wounds do not bleed much, but they are prone to be followed by the formation of matter or pus, and sometimes they are very difficult to clean thoroughly.

Treatment.—To clean the wound, use cold water and a *clean* sponge, or, preferably, a piece of clean rag or lint. If at hand, some carbolic acid should be added to the water, in the proportion of from 2 to 4 tea-spoons of the former to a pint of the latter. If the wound be irregular, and extends under the skin, this lotion must be gently injected with a syringe. The wound having been thoroughly cleaned, the edges are, if possible, to be brought together with sticking plaster, but care must be taken that the plaster is not applied too tightly, otherwise matter would be prevented from making its exit. The wound should now be covered with a piece of lint, or clean rag saturated with the above lotion, or with some carbolic oil in the above proportion. This should be covered with a little oiled silk cloth or a plantain leaf, and the whole lightly bandaged. Should much pus form, and the wound show no tendency to heal, remove the sticking plaster entirely, and if there is any unpleasant smell in the wound, apply a charcoal poultice to it.

PUNCTURED WOUNDS.—These wounds are produced by long, narrow, and sharp-pointed bodies, penetrating the flesh. As examples of these, we have wounds produced by treading on a soft splinter of wood, or a nail.

Treatment.—The first thing to do is to remove any foreign body that may be sticking in the wound, next stop any bleeding, wash the wound thoroughly, and allow the mouth of the wound to remain open, for there is a great tendency for the matter which may form to become blocked up. The general dressing may be conducted as in the case of lacerated wounds.

CONCLUSION.

THE rules of health and the ways adopted to prevent disease, are now being taught in schools almost throughout India. It is wise to learn the sanitary precepts we have laid down in this little book when young; but it will serve no useful purpose to learn, if we do not choose to practise them. We should apply them to ourselves, our house, and its surroundings, and to our daily mode of living.

The main points herein alluded to are :—

1. That *many diseases are preventable*, and that this prevention rests with ourselves by adopting proper sanitary rules in our daily life.
2. To always endeavour to secure, in our house and its surroundings, a sufficiency of *fresh air*.
3. To use pure drinking and cooking water, and if any water is stored in the house, to take every precaution to keep it from all sources of pollution.
4. To use wholesome food in sufficient, but not too great a quantity.
5. To wear suitable clothing.
6. To avoid all dirty habits, and to attend specially to the proper removal of all the waste matters from the body, human ordure, urine, &c.

7. To attend to personal cleanliness by bathing thoroughly and regularly.
8. To take a sufficient amount of exercise suitable to our age, climate, occupation, and sex.

We conclude with the remark that it is our earnest desire to improve the sanitary welfare of all classes of the people of India, and we would assert the fact that a due observance of the principles herein laid down will effect the objects pointed out in the INTRODUCTION of this book.

FINIS.

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